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MISSOURI

GEOLOGICAL SURVEY

VOLUME V.

PALEONTOLOGY OF MISSOURI

(PART II)

BY

CHARLES ROLLIN KEYES, A. M., Ph. D.,

STATE GEOLOGIST.

JEFFERSON CITY:
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1894.

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JEFFERSON CITY, June 1, 1894.

To the President, Governor Wm. J. Stone, and the members of the Board of Managers of the Bureau of Geology and Mines:

GENTLEMEN—I have the honor to transmit herewith the second part of my Report on the Paleontology of Missouri.

With great respect,

CHARLES R. KEYES,

State Geologist.

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PART II.

PREFACE.

The Paleontology of Missouri is contained in two volumes. Part I, which forms volume IV of the subject reports of the Missouri Geological Survey, and contains chapters I to IX and plates I to XXXII, has already been published. In addition to the consideration of the fossils, there is included an introductory chapter on the stratigraphy of the State, accompanied by a geological map compiled from the work of former surveys and data obtained by the present organization.

The second part of the Paleontology of Missouri is contained in the following pages. It embraces chapters X to XV and plates XXXIII to LIV of the entire work. In it are considered the Polyzoans, Brachiopods, Lamellibranchs, Gasteropods, Cephalopods and Vertebrates.

CHAPTER X.

POLYZOANS.

Phacelopora pertenuis ULRICH.

Plate xxxiii, fig. 3.

Phacelopora pertenuis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 406, pl. xxix, figs. 1-1c.

Horizon and localities—Lower Silurian, Trenton limestone: Thebes (Illinois); apparently the same form occurs in Missouri below Cape Girardeau.

Homotrypa arbuscula ULRICH.

Homotrypa arbuscula Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 409, pl. xxxviii, figs. 3-3c.

Horizon and localities—Lower Silurian, Trenton limestone: Calhoun county (Illinois).

Leioclema gracillimum ULRICH.

Leioclema gracillimum Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 429, pl. lxxv, figs. 6-6b.

Horizon and localities—Lower Carboniferous, Burlington limestone: Hannibal; Keokuk limestone: Clark county; Keokuk (Iowa); Warsaw (Illinois).

Leioclema punctatum (HALL).

Callopora punctata Hall, 1858: Geology Iowa, vol. I, p. 653.
Callopora missouriensis Rominger, 1866: Proc. Acad. Nat. Sci., Phila., p. 117.
Leioclema punctatum Ulrich, 1882: Jour. Cincinnati Soc. Nat. Hist., vol. V, p. 141, pl. vi, fig. 1-1a.
Leioclema punctatum Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 430.

Zoarium large, dichotomizing; branches three or four millimeters in diameter, and arising from broad basal expansions

or attached to foreign objects; surface even, often slightly spinous. Zoœcial walls thick; openings elliptical, surrounded by numerous small mesopores. Acanthopores rather large.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: LaGrange, Wayland and other places in northeastern Missouri; and in the same beds of the contiguous portions of the adjoining states.

Leioclema foliatum Ulrich.

Leioclema foliatum Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 431, fig. 1 (on p. 301).

Horizon and localities.—Lower Carboniferous, Keokuk beds: Warsaw (Illinois).

Leioclema araneum Ulrich.

Leioclema araneum Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 431, pl. lxxv, figs. 9–9c.

Horizon and localities.—Lower Carboniferous, Chester shales: Ste. Genevieve; Chester (Illinois).

Batostomella nitidula Ulrich.

Batostomella nitidula Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 436, pl. lxxv, figs. 3–3b.

Horizon and localities.—Lower Carboniferous, Chester shales: Chester (Illinois); apparently the same form as occurs in Ste. Genevieve county, Missouri.

Stenopora americana Ulrich.

Stenopora americana Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 437, pl. lxxv, figs. 1–1a.

Stenopora americana, var. *varsaviensis* Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 437, pl. lxxiv, figs. 3–3a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Stenopora montifera Ulrich.

Stenopora montifera Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p 438, pl. lxxiv, figs. 4–4b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Clark county; Bentonsport (Iowa).

Stenopora emanciata ULRICH.

Stenopora emanciata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 438, pl. lxxiv, figs. 2-2a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Stenopora intercalaris ULRICH.

Stenopora intercalaris Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 439, pl. lxxiv, figs. 5-5a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Stenopora angularis ULRICH.

Stenopora angularis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 439, pl. lxxiv, figs. 6-6b.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: LaGrange.

Stenopora intermittens ULRICH.

Stenopora intermittens Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 440, figs. 16a-b.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Stenopora tuberculata (PROUT).

Flustra tuberculata Prout, 1859: Trans. St. Louis Acad. Sci., vol. I, p. 447, pl. xvii, figs. 3-3d.

Cyclopora polymorpha ? Prout, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 578.

Cyclopora polymorpha Prout, 1866: Geol. Sur. Illinois, vol. II, p. 421, pl. xxi, figs. 5-5b.

Stenopora tuberculata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 441, figs. 17a-b.

Zoarium variable in size and shape, forming thin expansions on shells of brachiopods and the hard parts of other organisms; often free, with a well-defined and wrinkled epitheca on the under side. Surface nearly smooth. Zoœcial openings sub-circular or rounded polygonal; tubes prostrate at first, but rapidly curving outward; walls thin. Mesopores not abundant; diaphragms numerous. Acanthopores of medium size.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (Saint Louis county); Kaskaskia limestone: Chester (Illinois).

Stenopora cestriensis Ulrich.

Stenopora cestriensis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p 442, pl. lxxiv, figs. 7-7a.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Stenopora meekana Ulrich.

Stenopora meekana Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 443, pl lxxiii, figs. 7-7a.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Anisotrypa solida Ulrich.

Anisotrypa solida Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 449, pl. lxxii, figs. 9-9e.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Genevieve county; Chester (Illinois).

Fistulipora compressa Rominger.

Fistulipora compressa Rominger, 1866: Proc. Acad. Nat. Sci., Phila., p. 123.

Horizon and localities—Lower Carboniferous, Keokuk limestone: LaGrange, Wayland (Clark county).

Fistulipora carbonaria Ulrich.

Fistulipora carbonaria Ulrich, 1884: Jour. Cincinnati Soc. Nat. Hist., vol. VII, p. 45, pl. iii, figs. 1-1a.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Meekopora approximata Ulrich.

Meekopora approximata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 484, pl. lxxvii, fig. 5.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Meekopora clausa (ULRICH).

Fistulipora? clausa Ulrich, 1884: Jour. Cincinnati Soc. Nat. Hist., vol. VII, p. 47, pl. iii, figs. 4–4b.
Meekopora clausa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 485, pl. lxxvii, figs. 7–7b.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Strotopora foveolata ULRICH.

Strotopora foveolata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 487, pl. lxxvi, figs. 9–9a.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: St. Francisville; Bentonsport (Iowa); Warsaw (Illinois).

Strotopora dermata ULRICH.

Strotopora dermata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 488, pl. lxxvii, figs. 8-8a.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Cystodictya nitida ULRICH.

Cystodictya nitida Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 493, pl. lxxvi, figs. 4-4c.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: St. Franscisville (probably); Bentonsport (Iowa).

Cystodictya americana ULRICH.

Cystodictya americana Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 494, pl. lxxvi, figs. 5-5a.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Bentonsport (Iowa), and elsewhere on the lower Des Moines river.

Cystodictya pustulosa ULRICH

Cystodictya pustulosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 495, pl. lxxvi, figs. 2-2a.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Coscinium? latum Ulrich.

Coscinium latum Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 497, pl. lxxvi, figs. 7-7b.

Zoarium large, forming a broad, flattened, reticulated frond, with a large expanded basal portion attached to foreign objects. Zoœcial openings somewhat reniform, regularly arranged in rows.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal ?; Burlington (Iowa); Quincy (Illinois).

Dichotrypa intermedia Ulrich.

Dichotrypa intermedia Ulrich, 1890: Geol Sur. Illinois, vol. VIII, p. 500, pl. lxxvi, figs. 9-9c.

Zoarium forming broad, fan-shaped fronds, with attenuated margins; surface smooth, zoœcial apertures circular, and arranged in more or less distinct rows.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis.

Actinotrypa pecularis (Rominger).

Plate xxxiv, fig. 6.

Fistulipora pecularis Rominger, 1866: Proc. Acad. Nat. Sci., Phila., p. 123.
Actinotrypa pecularis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 503, pl. lxxvii, figs. 3-3b.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: LaGrange; Keokuk (Iowa).

Prismopora trifolia (Rominger).

Fistulipora trifolia Rominger, 1866: Proc. Acad. Nat. Sci., Phila., p. 122.
Prismopora trifolia Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 505, pl. lxxvii, figs. 4-4a.

Horizon and localities — Lower Carboniferous, Keokuk limestone: LaGrange; Keokuk (Iowa).

Evactinopora sexradiata Meek & Worthen.

Evactinopora sexradiata Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 502, pl. xvii, fig. 3.
Evactinopora sexradiata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 510, pl. lxxiii, figs. 2-2b.

Zoarium small, delicate, depressed, composed of six flattened expansions, radially placed. Zoœcial apertures subcircular, closely arranged.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Louisiana; Burlington (Iowa).

Evactinopora grandis MEEK & WORTHEN.

Evactinopora grandis Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 503, pl. xv, figs. 2a-b.

Evactinopora grandis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 511, pl. lxxiii, fig. 4.

A very large, robust form, with four rays arranged at right angles to one another, and measuring from 6 to 10 centimeters from end to end.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Louisiana, Hannibal.

Evactinopora radiata MEEK & WORTHEN.

Evactinopora radiata Meek & Worthen, 1865: Proc. Acad. Nat. Sci., Phila., p. 165.

Evactinopora radiata Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 502, pl. xvii, figs. 2a-b.

Evactinopora radiata Ulrich, 1884: Jour. Cincinnati Soc. Nat. Hist., vol. VII, p. 42, pl. ii, figs. 1-1e.

Evactinopora radiata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 509, pl. lxxiii, figs. 3-3a.

Zoarium ellipsoidal in outline when complete, consisting of from six to eight bilaminar vertical folia, arranged in a radiate manner. In the basal half of the zoarium the folia or rays are united and much thickened by a deposit of calcareous material, so that the "body" or the star as seen in the basal view is comparatively strong, and the rays are preserved in the regular rounded base as angular covering ridges, separated by at first very shallow then gradually deepening and widening furrows. At a point about midway between the summit and base where the rays become free, they are actually elliptical in transverse section, four or five mm. in width, with a non-poriferous border on each edge—the outer one a little the widest: from this point the margins are parellel for a short distance, then converge slowly, till they meet at the narrowly rounded

extremity. The whole base for nearly one-third the distance up the side of the rays is non-poriferous at the surface, the zoœcia apertures here being covered by a granulo-striate deposit of schlerenchyma decreasing in thickness upward. Zoœcia prostrate at first, then arising from the mesial laminæ proceed to each surface of the rays at an angle of about 45°. Apertures subcircular, oblique, the lower margin being most elevated; about 0.22 mm. Interspaces occupied by small lenticular vesicles, a few of which remain open, especially on each side of the mesial plane, the rest being filled and obscured by vertically perforated dense tissue, the perforations appearing in tangential sections as exceedingly numerous minute dark spots. Scattered among them are other spots of large size, that resemble acanthopores, in having the central portion lucid. Lunarium inconspicuous. (Ulrich.)

Horizon and localities—Lower Carboniferous, Keokuk limestone: Exact place not known.

Glyptopora plumosa (Prout).

Plate xxxiii, fig. 5.

Coscinium plumosum Prout, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 572.

Coscinium plumosum Prout, 1866: Geol. Sur. Illinois, vol. II, p. 414, pl. xxii, figs. 3-3b.

Glyptopora plumosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 512, pl. lxxviii, figs. 3-3c.

Zoarium consisting of one or more bilaminar thin expansions, arising from a common attached base, each having both surfaces traversed by strong bifurcating and coalescing ridges, so as to enclose large but rather shallow concave spaces or cups, varying, so far as observed, in length from 20 to 30 mm., and in width from 12 to 32 mm. The surface of the cups slopes gradually up to the base of the sharp edge ridges. At the bottom there is usually a long and narrow depressed macula or "dimple," and on each side, arranged in a more or less distinctly pinnate manner, are a series of long curving, sharply depressed parallel dimples, about 1.2 mm. wide, and from 7 to 16 mm. long.

The ridges on one side of the expansion correspond to the central depression on the other. Zoœcia apertures very slightly oblique, subcircular or oval, 0.15 to 0.20 mm. in diameter, arranged in from four to eight (usually five) alternating rows between the dimples, about nine in 3 mm. Peristome moderate, somewhat more elevated on one side than on the other. Interspaces depressed when perfect, usually about half as wide as the apertures. In thin sections the zoœcial tubes have moderately thick ring-like walls, a portion of the wall being distinguishable from the rest as the lunarium by its lighter color. A large number of small vesicles occupy the interspaces between the zoœcia walls. (Ulrich.)

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (Saint Louis county).

Glyptopora sagenella (Prout).

Coscinium sagenella Prout, 1859: Trans. St. Louis Acad. Sci., vol. I, p. 573.

Coscinium sagenella Prout, 1866: Geol. Sur. Illinois, vol. II, p. 415, pl. xxii, figs. 5–5a.

Glyptopora sagenella Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 513, pl. lxxviii, figs. 6–6a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Bentonsport (Iowa); Warsaw (Illinois).

Glyptopora megastoma Ulrich.

Glyptopora megastoma Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 518, pl. lxxviii, figs. 5–5a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk and Bentonsport (Iowa).

Glyptopora elegans (Prout).

Coscinium elegans Prout, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 572.

Coscinium elegans Prout, 1866: Geol. Sur. Illinois, vol. II, p. 431, pl. xxii, figs. 2–2a.

Glyptopora elegans Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 518, pl. lxxviii, figs. 10–10e.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Glyptopora keyserlingi (PROUT).

Coscinium keyserlingi Prout, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 269, pl. xv, figs. 4–4a.

Glyptopora keyserlingi Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 517, pl. lxxviii, figs. 4–4b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Glyptopora michelinia (PROUT).

Coscinium michelinia Prout, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 573.

Coscinium michelinia Prout, 1866: Geol. Sur. Illinois, vol. II, p. 414, pl. xxii, figs. 4–4a.

Glyptopora michelinia Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 515, pl. lxxviii, figs. 8–8b.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (Saint Louis county).

Tæniodictya ramulosa ULRICH.

Tæniodictya ramulosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 528, pl. lxvii, figs. 1–1b.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Tæniodictya frondosa ULRICH.

Tæniodictya frondosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 529, pl. lxix, figs. 5–5c.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Stictoporella basalis ULRICH.

Stictoporella basalis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 532, pl. lxxv, figs. 5–5b.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Fenestella filistriata ULRICH.

Fenestella filistriata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 535, pl. xlix, figs. 2-2a.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Montezuma (Illinois).

Fenestella rudis ULRICH.

Plate xxxiv, fig. 5.

Fenestella rudis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 537, pl. xlix, figs. 3-3d.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: St. Francisville.

Fenestella limitaris ULRICH.

Fenestella limitaris Ulrich, 1890: Geol. Sur. Illinois, vol VIII, p. 538, pl. xlix, figs. 4-4a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Fenestella multispinosa ULRICH.

Fenestella multispinosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 540, pl. l, figs. 3-3e.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Fenestella funicula ULRICH.

Fenestella funicula Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 542, pl. li, fig. 6.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Fenestella serratula ULRICH.

Fenestella serratula Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 544, pl. l, figs. 5-5c.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Fenestella cingulata ULRICH.

Fenestella cingulata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 543, pl. lii, figs. 1-1a.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa),

Fenestella banyana PROUT.

Fenestella banyana Prout, 1859: Trans. St. Louis Acad. Sci., vol. I, p. 450, pl. xviii, figs. 4-4b.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (St. Louis county).

Fenestella tenax Ulrich.

Fenestella tenax Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 546, pl. li, figs. 2–2e.

Horizon and localities—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Fenestella cestriensis Ulrich.

Fenestella cestriensis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. li, figs. 5–5b.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Fenestella flexuosa Ulrich.

Fenestella flexuosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 548, pl. li, figs. 4–4c.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Fenestella shumardi Prout.

Plate xxxiv, figs. 2a-b.

Fenestella shumardi Prout, 1868: Trans. St. Louis Acad. Sci., vol. I, p. 232.

Fenestella shumardi Meek, 1872: U. S. Geol. Sur. Nebraska, p. 153, pl. vii, figs. 3–ab.

Polyzoum growing apparently in flabelliform expansions and composing an extremely fine delicate network; branches very slender, of uniform size, rather flattened and comparatively coarsely striated on the non-poriferous side, bifurcating at rather regular intervals of from 0.20 to 0.25 inch, the divisions diverging but slightly; fenestrules oblong or about once and a half to nearly twice as long as wide, distinctly quadrangular, especially as seen on the non-poriferous side, and about equaling the breadth of the branches; dissepiments extremely slender or scarcely more than one-fourth as thick as the branches, not widened at the end on the non-poriferous side, but often somewhat expanded by a pore at one or both ends on the other side. Poriferous side with a mesial carina apparently sometimes bearing minute projecting points, and on each side of this angle about two and sometimes three compara-

tively large pores, generally arranged so that there is one at each end of each dissepiment, and another between these opposite each side of each fenestrule. (Meek.)

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Fenestella elevatipora ULRICH.

Fenestella elevatipora Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 549, pl. li, figs. 3-3a.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Hemitrypa hemitrypa (PROUT).

Fenestella hemitrypa Prout, 1859: Trans. St. Louis Acad. Sci., vol. I, p. 444, pl. xvii, figs. 3-3d.

Hemitrypa proutana Ulrich, 1890: Geol. Sur. Illinois, vol. VII, p. 560, pl. lvii, figs. 1-1c.

Horizon and localities—Lower Carboniferous, Saint Louis limestone: Barrett station (St. Louis county).

Hemitrypa aspera ULRICH.

Hemitrypa aspera Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 563, pl. lvii, figs. 4-4f.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Hemitrypa nodosa ULRICH.

Hemitrypa nodosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 562, pl. lvii, fig. 3.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Bentonsport (Iowa).

Hemitrypa perstriata ULRICH.

Hemitrypa perstriata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 564, pl. lvii, figs. 6-6a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Hemitrypa pateriformis ULRICH.

Hemitrypa pateriformis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 564, pl. lvii, figs. 7–7c.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Archimedes owenanus HALL.

Plate xxxiii, fig. 2.

Archimedes owenanus Hall, 1857: Proc. Am. As. Ad. Sci., vol. X. p. 178

Archimedes owenanus Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 570, pl. lxiii, figs. 6–6c.

Horizon and localities—Lower Carboniferous, Keokuk limestone: St. Francisville.

Archimedes wortheni HALL.

Plate xxxiii, fig. 1.

Archimedes wortheni Hall, 1857: Proc. Am. As. Ad. Sci. vol. X., p. 178.

Archimedes wortheni Hall, 1858: Geol. Iowa, vol. I. p. 651, pl. xxii, figs. 3, 4a–b, 5a-b.

Archimedes reversa Hall, 1858: Geology Iowa, vol. I, p. 652, pl. xxii, fig. 2.

Archimedes wortheni Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 571, pl. lviii, figs. 8–8a.

Zoarium large, flabellate, twisted; often attaining a measurement of 20 to 25 centimeters. Axis robust, elongate, fusiform; volutions quite regular; shaft short, abruptly and broadly expanding. Fenestrated portion very broad, with closely set, rigid branches, and consequently very narrow fenestrules. Zoœcial openings small, somewhat elevated.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Wayland, LaGrange.

Archimedes swallovanus HALL.

Archimedes swallovanus Hall, 1857: Proc. Am. As. Ad. Sci., vol. X, p. 173.

Archimedes swallovanus Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 574, pl. lxiii, figs. 12–12d.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Genevieve.

Archimedes laxus Hall.

Archimedes laxa Hall, 1857: Proc. Am. As. Ad. Sci., vol. X, p. 178.
Helicopora archimediformis Claypole, 1883: Quart. Jour. Geol. Soc, vol. XXXIX, p. 34, pl. iv, figs. 3-4.
Archimedes laxus Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 580, pl. lxiii, figs. 15-15a.

Horizon and localities.—Lower Carboniferous, Chester limestone: Chester (Illinois).

Lyropora retrosa Meek & Worthen.

Plate xxxiv, fig. 4.

Fenestella (Lyropora) retrosa Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 504, pl. xv, fig. 1.

Solid marginal support only known, the expanded, reticulate portion being always entirely removed. The two divisions of the lateral support diverge at an angle of ninety degrees, and are comparatively straight and slender. As in other species of this group, they have their inner edges oblique and not parallel to the plane of the fossil, while the minute, attenuated base of attachment is deflected toward the same side as the inner edge of the lateral marginal supports.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Louisiana.

Lyropora subquadrans Hall.

Lyropora subquadrans Hall, 1857: Proc. Am. As. Ad. Sci, vol. X, p. 180.
Lyropora subquadrans Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 582, pl. lviii, figs. 2-2e.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Lyropora quincuncialis Hall.

Lyropora quincuncialis Hall, 1857: Proc. Am As. Ad. Sci., vol X, p. 180.
Lyropora quincuncialis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 583, pl. lviii, figs. 3-3d.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Lyropora divergens Ulrich.

Lyropora divergens Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 584, pl. lviii, figs. 4-4b.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Polypora halliana Prout.

Polypora halliana Prout, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 580.

Polypora halliana Prout, 1866: Geol. Sur. Illinois, vol. II, p. 421, pl. xxi, figs. 4-4b.

Polypora halliana Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 587, pl. lix, figs. 5-5c.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Clark county.

Polypora maccoyana Ulrich.

Polypora maccoyana Ulrich, 1890: Geol. Sur Illinois, vol. VIII, p. 588, pl. lix, figs. 3-3d.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Polypora simulatrix Ulrich.

Polypora simulatrix Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 589, pl. lix, figs. 4-4b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Polypora gracilis Prout.

Polypora gracilis Prout, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 580.

Polypora gracilis Prout, 1866: Geol. Sur. Illinois, vol. II, p. 422, pl. xxi, figs. 1-1a.

Polypora gracilis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 590, pl. lxi, figs. 10-10a.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Polypora retrosa Ulrich.

Polypora retrorsa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 591, pl. lix, figs. 6–6d.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Polypora radialis Ulrich.

Polypora radialis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 591, pl. lx, figs. 1–1d.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Polypora spininodata Ulrich.

Polypora spininodata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 594, pl. lx, fig. 3.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Polypora biseriata? Ulrich.

Polypora biseriata? Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 592, pl. lx, figs. 4–4b.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (St. Louis county).

Polypora varsoviensis Ulrich.

Polypora varsoviensis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 593, pl. lx, figs. 2–2b.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (St. Louis county).

Polypora cestriensis Ulrich.

Polypora cestriensis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 549, pl. lv, figs. 4–4b.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Genevieve.

Polypora tuberculata Prout.

Polypora tuberculata Prout, 1859: Trans. St. Louis Acad. Sci., vol. I, p. 449, pl. xviii, fig. 8.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Polypora corticosa Ulrich.

Polypora corticosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 596, pl. lx, figs. 5-5c.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Polypora spinulifera Ulrich.

Polypora spinulifera Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 598, pl. lxi, figs. 2-2a.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Polypora submarginata Meek.

Polypora marginata Geinitz, 1866: Carb. und Dyas in Nebraska, p. 69, tab. v, figs. 11a-b. (Not McCoy, 1844.)

Polypora submarginata Meek, 1872: U. S. Geol. Sur. Nebraska, p. 154, pl. vii, figs. 7a-b.

Polypora submarginata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 602, pl. lxi, figs. 6-6b.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Kansas City. Probably Red Oak (Iowa) and Nebraska City (Nebraska).

Fenestralia? sancti-ludovici Prout.

Fenestralia sancti-ludovici Prout, 1859: Trans. St. Louis Acad. Sci., vol. I, p. 235, pl. xv, figs. 1-1a.

Fenestralia sancti-ludovici Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 604, pl. lv, fig. 5.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis.

Thamniscus furcillatus ULRICH.

Plate xxxiii, fig. 6.

Thamniscus furcillatus Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 609, pl. lxii, figs. 9-9b.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Genevieve.

Pinnatopora youngi ULRICH.

Pinnatopora youngi Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 615, pl. lxvi, fig. 3.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Pinnatopora vinei ULRICH.

Pinnatopora vinei Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 616, pl. lxvi, figs. 5-5b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Pinnatopora conferta ULRICH.

Pinnatopora conferta Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p 618, pl. lvi, fig. 5.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Pinnatopora trilineata (MEEK).

Glauconome trilineata Meek, 1872: U. S. Geol. Sur. Nebraska, p. 157, pl. vii, figs. 4b-d.

Pinnatopora trilineata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 620, pl. lxvi, fig. 6.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Ptilopora acuta ULRICH.

Ptilopora acuta Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 622, pl. lxv, figs. 4-4a.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Ptilopora valida Ulrich

Ptilopora valida Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 623, pl. lxv, figs. 5-5c.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Bentonsport (Iowa).

Ptilopora cylindracea Ulrich.

Ptilopora cylindracea Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 623, pl. lxvi, figs. 2-2b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Bentonsport (Iowa).

Ptilopora prouti Hall.

Ptilopora prouti Hall, 1858: Geology Iowa, vol. I, p. 653, pl. xxii, figs. 6a-6c.

Ptilopora prouti Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 625, pl. lxv, figs. 3-3c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (Saint Louis county).

Septopora cestriensis Prout.

Septopora cestriensis Prout, 1859: Trans. St. Louis Acad. Sci., vol. I, p. 448, pl. xviii, figs. 2-2b.

Septopora cestriensis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 628, pl. lxiv, figs. 1-1b.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Septopora biserialis (Swallow).

Plate xxxiv, figs. 1a-d.

Synocladia biserialis Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 179.

Synocladia virgulacea Geinitz, 1866: Carb. und Dyas in Nebraska, p. 70.

Synocladia biserialis Meek, 1872: U. S. Geol. Sur. Nebraska, p. 156, pl. vii, figs. 5a-5e.

Synocladia biserialis Meek, 1874: Am. Jour. Sci. (3), vol. VII, p. 486.

Synocladia biserialis Meek, 1875: Geol. Sur. Ohio. Pal., vol. II, p. 326, pl. xx, figs. 5-5 b.

Synocladia biserialis White, 1877: U. S. Geog Sur. w. 100 Merid., vol. IV, p. 107, pl. vii, figs. 3a-3c.

Synocladia biserialis White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., pt. II, p. 138, pl. xxv, figs. 11-13.
Synocladia biserialis Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 225.
Septopora biserialis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 631, pl. lvi, fig. 11.

Zoarium large, obconical, more or less irregular, usually folded; branches subequal, nearly parallel, united at regular intervals by lateral projections. Fenestrules usually more or less distinctly crescentic in shape. Zoœcial openings small, rather numerous.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Des Moines (Iowa); Upper Coal Measures: Kansas City.

Diplopora bifurcata Ulrich.

Diplopora bifurcata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 637, pl. lxii, figs. 12-12a.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Sphrogropora parasitica Ulrich.

Sphrogropora parasitica Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, pl. lxv, figs. 6-6a.

Horizon and localities—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Rhombopora dichotoma Ulrich.

Rhombopora dichotoma Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 650, pl. lxx, figs. 13-13b.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal ?; Burlington (Iowa).

Rhombopora varians Ulrich.

Rhombopora varians Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 652, pl. lxxi, figs. 1-1b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Rhombopora transversalis Ulrich.

Rhombopora transversalis Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 655, pl. lxxi, figs. 4-4b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Rhombopora attenuata Ulrich.

Rhombopora attenuata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 655, pl. lxx, fig. 7.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Rhombopora tabulata Ulrich.

Rhombopora tabulata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 658, pl. lxx, figs. 2–2c.

Horizon and localities—Lower Carboniferous, Kaskaskia limestone: Ste. Genevieve.

Rhombopora tenuirama Ulrich.

Rhombopora tenuirama Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 660, pl. lxx, figs. 8–8b.

Horizon and localities—Lower Carboniferous, Kaskaskia limestone: Kaskaskia (Illinois).

Rhombopora crassa Ulrich.

Rhombopora crassa Ulrich, 1884: Jour. Cincinnati Soc. Nat. Hist., vol. VII, p. 28, pl. i, figs. 2-2b.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Rhombopora lepidodendroides MEEK.

Plate xxxiii, figs. 4a-b.

Rhombopora lepidodendroides Meek, 1872: U. S. Geol. Sur. Nebraska, p. 141, pl. vii, figs. 2a-f.

Rhombopora lepidodendroides White, 1875: Expl. and Sur. w. 100 Merid., vol. IV, p. 99, pl. vi, figs. 5a-d.

Rhombopora lepidodendroides Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 225.

Ramose slender, cylindrical or slightly compressed, and bifurcated at regular, distant intervals; divisions nearly straight between the points of bifurcation, where they diverge at angles of about 70° to 80°; composed of small, short, nearly round, tapering tubes that ascend from an imaginary axis obliquely outward, with a more or less curve to the surface, near which they are separated by interspaces, which in cross-sections show the minute celluar structure; calyces arranged very regularly in quincunx, so as to form vertical and oblique rows; distinctly rhombic at the surface, where their margins are roughened by small prominent, node-like grains, placed one at each corner, with smaller granules along the edges between.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Bactropora simplex ULRICH.

Bactropora simplex Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 663, pl. lxx, figs. 14-14b.

Horizon and localities — Lower Carboniferous, Keokuk limestone: Clark county.

Streblotrypa major ULRICH.

Streblotrypa major Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 666, pl. lxxi, figs. 8-8d.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Streblotrypa radialis ULRICH.

Streblotrypa radialis Ulrich. 1890: Geol. Sur. Illinois, vol. VIII, p. 667, pl. lxxii, figs. 2-2d.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Bentonsport (Iowa).

Streblotrypa nicklesi ULRICH.

Streblotrypa nicklesi Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 667, pl. lxxi, figs. 9-9c.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Genevieve.

Streblotrypa distincta ULRICH.

Streblotrypa distincta Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 669, pl. lxxi, figs. 10-10b.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Worthenopora spinosa ULRICH.

Worthenopora spinosa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 669. pl. lxviii, figs. 1-1g.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Worthenopora spatulata (PROUT).

Flustra spatulata Prout, 1859: Trans. St. Louis Acad. Sci., vol. I, p. 446, pl. xvii, figs. 2-2c.

Worthenopora spatulata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p 670, pl. lxviii, figs. 2-2a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (St. Louis county).

Cyclopora fungia PROUT.

Cyclopora fungia Prout, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 577.

Cyclopora fungia Prout, 1866: Geol. Sur. Illinois, vol. II, p. 419, pl. xxii, figs. 9-9b.

Cyclopora fungia Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 671, pl. lxviii, figs. 3-3g.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: St. Francisville (Clark county).

Cyclopora expatiata Ulrich.

Cyclopora expatiata Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 673, pl. lxviii, figs. 4-4d.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Proutella discoidea (Prout).

Cyclopora discoidea Prout, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 578.

Cyclopora discoidea Prout, 1866: Geol. Sur. Illinois, vol. II, p. 420, pl. xxii, figs 10-10a.

Proutella discoidea Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 674, pl. lxix, figs. 4-4d.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Cycloporella spinifera Ulrich.

Cycloporella spinifera Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 675, pl. lxix, figs. 1-1c.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Cycloporella perversa Ulrich.

Cycloporella perversa Ulrich, 1890: Geol. Sur. Illinois, vol. VIII, p. 676, pl. lxix, figs. 3-3b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Bentonsport (Iowa).

CHAPTER XI.

BRACHIOPODS.

Lingula umbonata Cox.

Plate xxxv, fig. 4.

Lingula umbonata Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 576, pl. x, fig. 4.

Lingula carbonaria Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 215.

Lingula mytiloides Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 572, pl. xxv, fig. 12. (Not Sowerby, 1813).

Lingula umbonata White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., pt. ii, p. 120, pl. xxv, fig. 14.

Lingula umbonata Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 226.

Shell thin, elliptical, sightly convex, wider in front than back of the middle, margins regularly rounding, rather sharply on the posterior border; umbo rather prominent; beak small.

Horizon and localities.—Upper Carboniferous, Coal Measures: Clinton (Henry county), Kansas City.

Lingulella lamborni Meek.

Plate xxxv, figs 5a-d.

Lingulella lamborni Meek, 1871: Proc. Acad. Nat. Sci., Phila., p. 185, figs. 1-4.

Shell small, compressed, broadly subovate, about one-fifth longer than wide. Ventral valve pointed at the beak, from which the nearly straight lateral slopes diverge at an angle of about 35°, to near the middle of each lateral margin, then regularly rounding forward; false cardinal area well developed and extending back, with the beak nearly one-fourth the length of the valve, behind that of the other valve, and having its mesial furrow for the peduncle well-defined, on each side of which is a diverging longitudinal line extending from the apex of the beak, so as to form the margins of the false area, which

is transversely striated; the interior marked by numerous little irregularly scattered pits, which are largest posteriorly and diminish in size forward; while near the anterior margin very obscure traces of minute radiating striæ are sometimes seen; internal scars presenting a trilobate appearance, there being a short, mesial, rounded lobe nearly reaching to the middle of the valve; and nearly half way between this and each posterior lateral margin there is a long, slender, diverging lateral lobe or impression. Dorsal valve shorter than the other and subcircular in outline, its beak being apparently a little truncated; interior showing the same pitted appearance seen in the other valve; visceral and muscular impressions unknown. Surface of both valves marked by five concentric lines.

Horizon and localities.—Cambrian shales: Mine LaMotte (Madison county).

Discina nitida (Phillips).

Plate xxxv, fig. 6.

Orbicula nitida Phillips, 1836: Geol. Yorkshire, vol. II, p. 221, pl. xi, figs. 10-13.

Discina missouriensis Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 221.

Discina capuliformis McChesney, 1859: Desc. New Sp. Foss. Western States, p. 72.

Discina nitida Meek & Worthen, 1868: Geol. Sur. Illinois, vol. V, p. 572, pl. xxv, fig. 1.

Discina nitida White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 121, pl. xxv, fig. 9.

Discina nitida Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 226.

Shell small, circular in outline, low, conical, sides sloping nearly straight from the apex to the margins; apex situated toward the posterior border; opposite valve flat. Surface marked by concentric lines.

Horizon and localities.—Upper Carboniferous, Coal Measures: Clinton (Henry county), Lexington, Richmond (Ray county).

Discina newberryi Hall.

Discina newberryi Hall, 1864: Sixteenth Rep. Reg. State Cab. Nat. Hist. New York, p. 30.

Discina newberryi Hall, 1869: Pal. New York, vol. IV, p. 25, pl. 1, figs. 10-11.

Discina newberryi Meek, 1875; Geol. Sur. Ohio, Pal, vol. II, p. 277, pl. xiv, figs. 1a-d.

Discina sampsoni Miller, 1892: Geol. Sur. Indiana, 17th Ann. Rep., p. 80, pl. xiii, figs. 10-12.

Similar to *D. nitida*, but higher, and with the apex submarginal.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Sedalia, Springfield, Louisiana.

Discina convexa Shumard.

Plate xxxv, fig. 7.

Discina convexa Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 221.

Discina convexa White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 121, pl. xxv, fig. 9.

Like *D. nitida* but very much larger; often reaching a diametric measurement of nearly an inch.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: near Richmond (Ray county).

Crania lævis *Sp. nov.*

Shell rather above medium size, somewhat depressed; apex subcentral; margins regularly rounded except on one side, which is truncated. Muscular scars prominent. Surface marked by concentric lines of growth.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Louisiana; and Burlington limestone: Louisiana.

Productus arcuatus Hall.

Productus arcuatus Hall, 1858: Geology Iowa, vol. I, p. 513, pl. vii, figs. 4a-b.

Productus cooperensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 640.

Shell small, with the ventral valve very long and arched, the hinge line short; surface marked by broad rounded radiating ridges, which are crossed by fine concentric lines.

Horizon and localities—Lower Carboniferous, Kinderhook beds: Hannibal (Marion county).

Productus lævicostus White.

Plate xxxviii, fig. 1.

Productus lævicostus White, 1860: Boston Jour. Nat. Hist., vol. VII, p. 230.

Productus coræformis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 94.

Closely approaching *P. cora*, but narrower and more slender.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Louisiana; Burlington limestone: Louisiana.

Productus burlingtonensis Hall.

Productus flemingi, var. *burlingtonensis* Hall, 1858: Geology Iowa, vol. I, p. 598, pl. xii, figs. 3a-g.

Productus mesialis Hall, 1858: Geology Iowa, vol. I, p. 636, pl. xix, figs. 2a-c.

Shell rather above medium size, longer than wide, strongly arched; hinge-line shorter than greatest width of shell. Radiating costæ rather coarse.

Horizon and localities—Lower Carboniferous, Burlington limestone: Hannibal, Helton (Marion county), Louisiana, Springfield, Ash Grove (Greene county); Keokuk limestone: St. Francisville (Clark county), Boonville (Cooper county).

Productus magnus Meek & Worthen.

Productus magnus Meek & Worthen, 1861: Proc. Acad. Nat. Sci., Phila., p. 142.

Productus pentonensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 93.

Productus magnus Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 528, pl. xx, figs. 7a-c.

Shell attaining a large size, subhemispherical, or in outline semioval; hinge line equaling, or slightly exceeding, the greatest breadth of the valves at any other part; ears nearly rectangular, not arched. Ventral valve moderately gibbous, or forming a more or less nearly regular, semicircular curve

from the beak to the front, rounding down rather strongly on each side to the ears, which are not abruptly separated from the swell of the umbo; central region with a shallow, narrow mesial sinus, extending from the front about two-thirds of the way to the beak; umbonal region not very prominent; beak small, incurved, and passing but slightly beyond the hinge-margin; interior unknown. Dorsal valve distinctly concave but nearly flat over a large portion of the central region, and strongly curving up at the front and lateral margins, usually with a slight mesial ridge corresponding to the sinus of the other valve. Interior with a rugose ridge extending around near the front and lateral margins, so as to present a somewhat geniculated appearance, not seen on the outside; cardinal process stout, apparently rather short, and bifid, its base forming a short stout ridge, which soon becomes obsolete near the muscular scars, from between which a narrow ridge extends forward two-thirds to three-fourths the length of the valve, becoming sharply elevated and thin at the end; scars of adductor muscles elongated, parallel and rugose; reniform scars rather broad, and somewhat roughened by a few irregular wart-like prominences; space between the reniform scars and the mesial ridge flat, and without any traces of the sub-conical prominences seen in *P. giganteus*; posterior lateral regions irregularly pitted or punctured.

Surface of both valves ornamented by numerous, rather coarse, often waved or flexuous striæ, or small obscure costæ, that increase by intercalation and division, all sometimes becoming nearly obsolete on or near the ears; fine concentric striæ are also seen on all parts of the surface, and over the visceral region very obscure traces of small concentric wrinkles likewise occur. On the ventral valve, bases of small spines are seen irregularly scattered, being most numerous, largest and closely arranged on the ears and along the hinge-margin. No spines occur on the dorsal valve, but little pits seem to occupy their places. (**Meek.**)

***Horizon and localities.*—Lower Carboniferous, Keokuk limestone; Ste. Genevieve, St. Francisville (Clark county).**

Productus biseriatus Hall.

Productus biseriatus Hall, 1856: Trans. Alabany Inst., vol. IV, p. 12.
Productus biseriatus Whitefield, 1882: Bul. Am. Mus. Nat. Hist., No. 3, p. 46, pl. vi, figs. 8–12.
Productus biseriatus Hall, 1883: Geol. Sur. Indiana, 12th Ann. Rep., p. 325, pl. xxix, figs. 8–12.

This shell belongs to the *P. punctatus* group, but is very small as compared with the typical species.

Horizon and localities — Lower Carboniferous, Keokuk limestone: St. Francisville (Clark county); Keokuk (Iowa).

Productus vittatus Hall.

Productus vittatus Hall, 1858: Geology Iowa, vol. I, p. 639.
Productus gradatus Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II. p 93.

Like *P. punctatus* of the Coal Measures, and perhaps identical with it.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Trenton (St. Louis county); Keokuk (Iowa).

Productus altonensis Norwood & Pratten.

Productus altonensis Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila, vol III, p. 7, pl. i, figs. 1a–3.

Like *P. arcuatus*, but less arched, and with fewer radial costæ.

Horizon and localities —Lower Carboniferous, Saint Louis limestone: St. Louis.

Productus marginicinctus Prout.

Productus marginicinctus Prout, 1855: Trans. St. Louis Acad. Sci., vol I, p. 43, pl. ii, fig 1.
Productus wortheni Hall, 1858: Geology Iowa, vol. I., p. 635, pl. xix, figs. 1a–b.
Productus marginicinctus Hall, 1858: Geology Iowa, vol I, p. 664, pl. xxiv, figs. 3a–c.

Shell small, costate, with a marginal thickening.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis; Keokuk (Iowa).

Productus ovatus Hall.

Productus ovatus Hall, 1858: Geology Iowa, vol. I, p. 674, pl. xxiv, fig. 1.

A small oval form, with fine radiating costæ.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis.

Productus tenuicostus Hall.

Productus tenuicostus Hall, 1858: Geology Iowa, vol. I, p. 675, pl. xxiv, figs. 2a–d.

Closely related to and perhaps identical with *P. lævicostus*.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis.

Productus cestriensis Worthen.

Productus elegans Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., vol. III, p. 13, pl. i, figs. 7a–e (Not McCoy, 1844.)

Productus cestriensis Worthen, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 570.

Productus parvus Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 450.

Productus parvus Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 297, pl. xxiii, figs. 4a–e.

Shell small, arcuate, with hinge-line shorter than greatest width. Radiating costæ coarse.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Productus americanus Swallow.

Productus americanus Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 91.

According to Meek & Worthen this form is closely related to their *P. magnus*.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Harrison county.

Productus longispinus SOWERBY.

Plate xxxvii, fig. 4a-b.

Productus longispinus Sowerby, 1814: Min. Conch., vol. I, p. 154, pl. lxviii, fig. 1.

Productus splendens Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila , (2), vol. II, p. 2, pl. i, figs. 5a-d.

Productus wabashensis Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 13, pl. i, fig. 6.

Productus muricatus Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 14, pl. i, figs. 8a-e. (Not Phillips.)

Productus muricatus Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 573, pl. ix, fig. 6.

Productus costatoides Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 217.

Productus orbignyanus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 56, tab. iv, figs. 8, 9, 10, 11. (Not deKoninck, 1844.)

Productus horridus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 56, tab. iv, fig. 7. (Not Sowerby, 1822.)

Productus longispinus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 161, pl. vi, fig. 7, pl. viii, figs. 6a-c.

Productus muricatus White, 1875: U. S. Geol. Sur. W. 100 Merid., vol. IV, p. 120, pl. viii, fig. 4a-c.

Productus longispinus Meek, 1877: Geol. Exp. 40 Par., vol. IV, p. 78, pl. viii, figs. 4-4a.

Productus muricatus Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 228.

Shell small, thin, somewhat wider than long; hinge-line longer than greatest width of shell. Ventral valve arched, with greatest convexity behind middle; mesial sinus well defined, broadly rounding; beak small, incurved, projecting beyond the hinge-line. Ventral valve concave, following closely the curve of the opposite one. Surface marked by obscure radiating costæ, which often become obsolete over nearly the entire shell; these are often crossed by distinct concentric folds, which are more pronounced toward the beak; spines few, scattered.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

There seems to be but little doubt now that Norwood & Pratten's species *P. splendens* and *P. wabashensis* are identical with the form under consideration. In regard to certain other allied shells reported by Geinitz from Nebraska, and their relations to *P. longispinus*, Meek says: "Concerning the iden-

tity of this shell with *P. orbignyi*, I am compelled to differ from Professor Geinitz. I am also satisfied, as elsewhere stated, that the little shell figured by Professor Geinitz under the name *P. horridus* on his plate iv (Carb. und Dyas in Nebraska) is nothing but a young individual of the species under consideration. This shell varies much in the distinctness of its costæ, which are usually rather obscure. It is but necessary to examine a few good specimens to see by their smooth, non-costate umbonal region that they often attain a size even greater than that he has referred to *P. horridus*, without showing the slightest traces of radiating costæ. Indeed, some individuals of mature size show but faint indications of ribs even near the front margin, while the various individuals present every intermediate gradation in this character between these and the most distinctly ribbed specimens. In addition to this, the extreme improbability of there being in these rocks a large, conspicuous species like *P. horridus*, when no traces of such a shell have ever been seen among all the vast collections that have been obtained from them throughout the great area in which they occur in the West, would alone be a sufficient reason for rejecting the conclusion that such a mere mite as this is the young of that species. But the necessity for such an improbable conclusion is entirely removed by the fact that this specimen was found associated with a very common and abundant species, the young of which evidently agrees exactly with it."

Regarding the form described by Norwood & Pratten as *Productus muricatus*, there is considerable doubt as to its identity with the *P. longispinus* of the Mississippi valley, although both Meek and Davidson so considered it. Throughout some parts of the continental interior at least, *P. muricatus* N. & P. presents characteristics that are remarkably constant; and when associated with *P. longispinus*, no hesitancy whatever would be entertained in separating the two forms. Were it not for the fact that the name *P. muricatus* had been used in 1836 by Phillips in his Geology of Yorkshire, Norwood & Pratten's species would be treated here as distinct from the shell

usually referred to Sowerby's form. But inasmuch as the synonymy of the species is still unsettled it does not appear advisable to propose a new term for the American *P. muricatus.*

Productus cora D'ORBIGNY.

Plate xxxvii, figs. 2a-c.

Productus cora d'Orbigny, 1843: Voyage dans l' Amerique Meridionale.
Productus cora Owen, 1852: Geol. Sur. Iowa, Wisconsin and Minnesota, tab. v, fig. 1.
Productus semireticulatus Hall, 1852: Stanbury's Exp. Gt Salt Lake, p. 411, pl. iii, figs. 4, 5. (Not Martin, 1809.)
Productus prattenianus Norwood & Pratten, 1854: Jour. Acad. Nat Sci., Phila. (2), vol. III, p. 17, pl. i, figs. 10a-d.
Productus hildrethianus Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila. (2), vol. III, p. 18, pl. i, figs. 11a-c.
Productus æquicostatus Shumard, 1855: Geol. Sur. Missouri, Ann. Rept., p. 201, pl. E, fig. 10.
Productus cora Marcou, 1858: Geol. N. A., pl. vi, figs. 4-4a.
Productus flemingi Geinitz, 1866: Carb. und Dyas in Nebraska, p. 52, tab. iv, figs. 1, 2, 3, 4.
Productus calhounianus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 51. (Not Swallow, 1858.)
Productus koninckianus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 53, tab. iv, fig. 4. (Not de Verneuil, 1845.)
Productus prattenianus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 163, pl. ii, figs. 5a-c; pl. v, figs. 1-3, pl. viii, figs. 10a-b.
Productus prattenianus White, 1875: U. S. Geol. Sur. w. 100 Merid., vol. IV, p. 113, pl. vii, figs. 10a-c.
Productus cora White, 1884: Geol. Sur. Indiana, Ann. Rep. 1883, p. 126, pl. xxvi, figs. 1, 2, 3.
Productus cora Keyes, 1888: Proc. Acad. Nat Sci., Phila., p. 227.

Shell of medium size, regularly rounded anteriorly, as long as wide, length of hinge-line equal to greatest breadth. Ventral valve regularly arched, with no medial sinus; umbonal region more or less gibbous; beak incurved; ears rather large, somewhat compressed, with a few well-marked wrinkles. Dorsal valve decidedly concave, slightly flattened posteriorly. Surface marked by numerous fine, radiating costæ, and on the ventral side by a few scattered spines.

Horizon and localities.—Upper Carboniferous, Coal Measures: Calhoun (Henry county), Kansas City.

Productus cora was originally described from South America; while in North America the same form has been given, at

CHAPTER XI.

BRACHIOPODS.

Lingula umbonata Cox.

Plate xxxv, fig. 4.

Lingula umbonata Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 576, pl. x, fig. 4.

Lingula carbonaria Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 215.

Lingula mytiloides Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 572, pl. xxv, fig. 12. (Not Sowerby, 1813).

Lingula umbonata White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., pt. ii, p. 120, pl. xxv, fig. 14.

Lingula umbonata Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 226.

Shell thin, elliptical, sightly convex, wider in front than back of the middle, margins regularly rounding, rather sharply on the posterior border; umbo rather prominent; beak small.

Horizon and localities.—Upper Carboniferous, Coal Measures: Clinton (Henry county), Kansas City.

Lingulella lamborni Meek.

Plate xxxv, figs 5a-d.

Lingulella lamborni Meek, 1871: Proc. Acad. Nat. Sci., Phila., p. 185, figs. 1-4.

Shell small, compressed, broadly subovate, about one-fifth longer than wide. Ventral valve pointed at the beak, from which the nearly straight lateral slopes diverge at an angle of about 35°, to near the middle of each lateral margin, then regularly rounding forward; false cardinal area well developed and extending back, with the beak nearly one-fourth the length of the valve, behind that of the other valve, and having its mesial furrow for the peduncle well-defined, on each side of which is a diverging longitudinal line extending from the apex of the beak, so as to form the margins of the false area, which

is transversely striated; the interior marked by numerous little irregularly scattered pits, which are largest posteriorly and diminish in size forward; while near the anterior margin very obscure traces of minute radiating striæ are sometimes seen; internal scars presenting a trilobate appearance, there being a short, mesial, rounded lobe nearly reaching to the middle of the valve; and nearly half way between this and each posterior lateral margin there is a long, slender, diverging lateral lobe or impression. Dorsal valve shorter than the other and subcircular in outline, its beak being apparently a little truncated; interior showing the same pitted appearance seen in the other valve; visceral and muscular impressions unknown. Surface of both valves marked by five concentric lines.

Horizon and localities.—Cambrian shales: Mine LaMotte (Madison county).

Discina nitida (PHILLIPS).

Plate xxxv, fig. 6.

Orbicula nitida Phillips, 1836: Geol. Yorkshire, vol. II, p. 221, pl. xi, figs. 10-13.

Discina missouriensis Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 221.

Discina capuliformis McChesney, 1859: Desc. New Sp. Foss. Western States, p. 72.

Discina nitida Meek & Worthen, 1868: Geol. Sur. Illinois, vol. V, p. 572, pl. xxv, fig. 1.

Discina nitida White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 121, pl. xxv, fig. 9.

Discina nitida Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 226.

Shell small, circular in outline, low, conical, sides sloping nearly straight from the apex to the margins; apex situated toward the posterior border; opposite valve flat. Surface marked by concentric lines.

Horizon and localities.—Upper Carboniferous, Coal Measures: Clinton (Henry county), Lexington, Richmond (Ray county).

Discina newberryi Hall.

Discina newberryi Hall, 1864: Sixteenth Rep. Reg. State Cab. Nat. Hist. New York, p. 30.

Discina newberryi Hall, 1869: Pal. New York, vol. IV, p. 25, pl. i, figs. 10–11.

Discina newberryi Meek, 1875; Geol. Sur. Ohio, Pal, vol. II, p. 277, pl. xiv, figs. 1a–d.

Discina sampsoni Miller, 1892: Geol. Sur. Indiana, 17th Ann. Rep., p. 80, pl. xiii, figs. 10–12.

Similar to *D. nitida*, but higher, and with the apex submarginal.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Sedalia, Springfield, Louisiana.

Discina convexa Shumard.

Plate xxxv, fig. 7.

Discina convexa Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 221.

Discina convexa White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 121, pl. xxv, fig. 9.

Like *D. nitida* but very much larger; often reaching a diametric measurement of nearly an inch.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: near Richmond (Ray county).

Crania lævis *Sp. nov.*

Shell rather above medium size, somewhat depressed; apex subcentral; margins regularly rounded except on one side, which is truncated. Muscular scars prominent. Surface marked by concentric lines of growth.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Louisiana; and Burlington limestone: Louisiana.

Productus arcuatus Hall.

Productus arcuatus Hall, 1858: Geology Iowa, vol. I, p. 513, pl. vii, figs. 4a–b.

Productus cooperensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 640.

Shell small, with the ventral valve very long and arched, the hinge line short; surface marked by broad rounded radiating ridges, which are crossed by fine concentric lines.

Horizon and localities—Lower Carboniferous, Kinderhook beds: Hannibal (Marion county).

Productus lævicostus White.

Plate xxxviii, fig. 1.

Productus lævicostus White, 1860: Boston Jour. Nat. Hist., vol. VII, p. 230.

Productus coræformis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 94.

Closely approaching *P. cora*, but narrower and more slender.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Louisiana; Burlington limestone: Louisiana.

Productus burlingtonensis Hall.

Productus flemingi, var. *burlingtonensis* Hall, 1858: Geology Iowa, vol. I, p. 598, pl. xii, figs. 3a–g.

Productus mesialis Hall, 1858: Geology Iowa, vol. I, p. 636, pl. xix, figs. 2a–c.

Shell rather above medium size, longer than wide, strongly arched; hinge-line shorter than greatest width of shell. Radiating costæ rather coarse.

Horizon and localities—Lower Carboniferous, Burlington limestone: Hannibal, Helton (Marion county), Louisiana, Springfield, Ash Grove (Greene county); Keokuk limestone: St. Francisville (Clark county), Boonville (Cooper county).

Productus magnus Meek & Worthen.

Productus magnus Meek & Worthen, 1861: Proc. Acad. Nat. Sci., Phila., p. 142.

Productus pentonensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 93.

Productus magnus Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 528, pl. xx, figs. 7a–c.

Shell attaining a large size, subhemispherical, or in outline semioval; hinge line equaling, or slightly exceeding, the greatest breadth of the valves at any other part; ears nearly rectangular, not arched. Ventral valve moderately gibbous, or forming a more or less nearly regular, semicircular curve

from the beak to the front, rounding down rather strongly on each side to the ears, which are not abruptly separated from the swell of the umbo; central region with a shallow, narrow mesial sinus, extending from the front about two-thirds of the way to the beak; umbonal region not very prominent; beak small, incurved, and passing but slightly beyond the hinge-margin; interior unknown. Dorsal valve distinctly concave but nearly flat over a large portion of the central region, and strongly curving up at the front and lateral margins, usually with a slight mesial ridge corresponding to the sinus of the other valve. Interior with a rugose ridge extending around near the front and lateral margins, so as to present a somewhat geniculated appearance, not seen on the outside; cardinal process stout, apparently rather short, and bifid, its base forming a short stout ridge, which soon becomes obsolete near the muscular scars, from between which a narrow ridge extends forward two-thirds to three-fourths the length of the valve, becoming sharply elevated and thin at the end; scars of adductor muscles elongated, parallel and rugose; reniform scars rather broad, and somewhat roughened by a few irregular wart-like prominences; space between the reniform scars and the mesial ridge flat, and without any traces of the sub-conical prominences seen in *P. giganteus;* posterior lateral regions irregularly pitted or punctured.

Surface of both valves ornamented by numerous, rather coarse, often waved or flexuous, striæ, or small obscure costæ, that increase by intercalation and division, all sometimes becoming nearly obsolete on or near the ears; fine concentric striæ are also seen on all parts of the surface, and over the visceral region very obscure traces of small concentric wrinkles likewise occur. On the ventral valve, bases of small spines are seen irregularly scattered, being most numerous, largest and closely arranged on the ears and along the hinge-margin. No spines occur on the dorsal valve, but little pits seem to occupy their places. (Meek.)

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Ste. Genevieve, St. Francisville (Clark county).

Productus biseriatus HALL.

Productus biseriatus Hall, 1856: Trans. Alabany Inst., vol. IV, p. 12.
Productus biseriatus Whitefield, 1882: Bul. Am. Mus. Nat. Hist., No. 3, p. 46, pl. vi, figs. 8–12.
Productus biseriatus Hall, 1883: Geol. Sur. Indiana, 12th Ann. Rep., p. 325, pl. xxix, figs. 8–12.

This shell belongs to the *P. punctatus* group, but is very small as compared with the typical species.

Horizon and localities — Lower Carboniferous, Keokuk limestone: St. Francisville (Clark county); Keokuk (Iowa).

Productus vittatus HALL.

Productus vittatus Hall, 1858: Geology Iowa, vol. 1, p. 639.
Productus gradatus Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II. p 93.

Like *P. punctatus* of the Coal Measures, and perhaps identical with it.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Trenton (St. Louis county); Keokuk (Iowa).

Productus altonensis NORWOOD & PRATTEN.

Productus altonensis Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., vol III, p. 7, pl. 1, figs. 1a–3.

Like *P. arcuatus*, but less arched, and with fewer radial costæ.

Horizon and localities —Lower Carboniferous, Saint Louis limestone: St. Louis.

Productus marginicinctus PROUT.

Productus marginicinctus Prout, 1855: Trans. St. Louis Acad. Sci., vol I, p. 43, pl. ii, fig 1.
Productus wortheni Hall, 1858: Geology Iowa, vol. I., p. 635, pl. xix, figs. 1a–b.
Productus marginicinctus Hall, 1858: Geology Iowa, vol I, p. 664, pl. xxiv, figs. 3a–c.

Shell small, costate, with a marginal thickening.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis; Keokuk (Iowa).

Productus ovatus Hall.

Productus ovatus Hall, 1858: Geology Iowa, vol. I, p. 674, pl. xxiv, fig. 1.

A small oval form, with fine radiating costæ.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis.

Productus tenuicostus Hall.

Productus tenuicostus Hall, 1858: Geology Iowa, vol. I, p. 675, pl. xxiv, figs. 2a-d.

Closely related to and perhaps identical with *P. lævicostus.*

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis.

Productus cestriensis Worthen.

Productus elegans Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., vol. III, p. 13, pl. i, figs. 7a-c (Not McCoy, 1844.)

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Productus parvus Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 450.

Productus parvus Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 297, pl. xxiii, figs. 4a-e.

Shell small, arcuate, with hinge-line shorter than greatest width. Radiating costæ coarse.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Productus americanus Swallow.

Productus americanus Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 91.

According to Meek & Worthen this form is closely related to their *P. magnus.*

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Harrison county.

Productus longispinus Sowerby.

Plate xxxvii, fig. 4a-b.

Productus longispinus Sowerby, 1814: Min. Conch., vol. I, p. 154, pl. lxviii, fig. 1.

Productus splendens Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila, (2), vol. II, p. 2, pl. i, figs. 5a–d.

Productus wabashensis Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 13, pl. i, fig. 6.

Productus muricatus Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 14, pl. i, figs. 8a–e. (Not Phillips.)

Productus muricatus Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 573, pl. ix, fig. 6.

Productus costatoides Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 217.

Productus orbignyanus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 56, tab. iv, figs. 8, 9, 10, 11. (Not deKoninck, 1844.)

Productus horridus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 56, tab. iv, fig. 7. (Not Sowerby, 1822.)

Productus longispinus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 161, pl. vi, fig. 7, pl. viii, figs. 6a-c.

Productus muricatus White, 1875: U. S. Geol. Sur. W. 100 Merid., vol. IV, p. 120, pl. viii, fig. 4a–c.

Productus longispinus Meek, 1877: Geol. Exp. 40 Par., vol. IV, p. 78, pl. viii, figs. 4–4a.

Productus muricatus Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 228.

Shell small, thin, somewhat wider than long; hinge-line longer than greatest width of shell. Ventral valve arched, with greatest convexity behind middle; mesial sinus well defined, broadly rounding; beak small, incurved, projecting beyond the hinge-line. Ventral valve concave, following closely the curve of the opposite one. Surface marked by obscure radiating costæ, which often become obsolete over nearly the entire shell; these are often crossed by distinct concentric folds, which are more pronounced toward the beak; spines few, scattered.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

There seems to be but little doubt now that Norwood & Pratten's species *P. splendens* and *P. wabashensis* are identical with the form under consideration. In regard to certain other allied shells reported by Geinitz from Nebraska, and their relations to *P. longispinus*, Meek says: "Concerning the iden-

tity of this shell with *P. orbignyi*, I am compelled to differ from Professor Geinitz. I am also satisfied, as elsewhere stated, that the little shell figured by Professor Geinitz under the name *P. horridus* on his plate iv (Carb. und Dyas in Nebraska) is nothing but a young individual of the species under consideration. This shell varies much in the distinctness of its costæ, which are usually rather obscure. It is but necessary to examine a few good specimens to see by their smooth, non-costate umbonal region that they often attain a size even greater than that he has referred to *P. horridus*, without showing the slightest traces of radiating costæ. Indeed, some individuals of mature size show but faint indications of ribs even near the front margin, while the various individuals present every intermediate gradation in this character between these and the most distinctly ribbed specimens. In addition to this, the extreme improbability of there being in these rocks a large, conspicuous species like *P. horridus*, when no traces of such a shell have ever been seen among all the vast collections that have been obtained from them throughout the great area in which they occur in the West, would alone be a sufficient reason for rejecting the conclusion that such a mere mite as this is the young of that species. But the necessity for such an improbable conclusion is entirely removed by the fact that this specimen was found associated with a very common and abundant species, the young of which evidently agrees exactly with it."

Regarding the form described by Norwood & Pratten as *Productus muricatus*, there is considerable doubt as to its identity with the *P. longispinus* of the Mississippi valley, although both Meek and Davidson so considered it. Throughout some parts of the continental interior at least, *P. muricatus* N. & P. presents characteristics that are remarkably constant; and when associated with *P. longispinus*, no hesitancy whatever would be entertained in separating the two forms. Were it not for the fact that the name *P. muricatus* had been used in 1836 by Phillips in his Geology of Yorkshire, Norwood & Pratten's species would be treated here as distinct from the shell

usually referred to Sowerby's form. But inasmuch as the synonymy of the species is still unsettled it does not appear advisable to propose a new term for the American *P. muricatus*.

Productus cora D'ORBIGNY.

Plate xxxvii, figs. 2a-c.

Productus cora d'Orbigny, 1843: Voyage dans l' Amerique Meridionale.

Productus cora Owen, 1852: Geol. Sur. Iowa, Wisconsin and Minnesota, tab. v, fig. 1.

Productus semireticulatus Hall, 1852: Stanbury's Exp. Gt Salt Lake, p. 411, pl. iii, figs. 4, 5. (Not Martin, 1809.)

Productus prattenianus Norwood & Pratten, 1854: Jour. Acad. Nat Sci., Phila. (2), vol. III, p. 17, pl. i, figs. 10a-d.

Productus hildrethianus Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila. (2), vol. III, p. 18, pl. i, figs. 11a-c.

Productus æquicostatus Shumard, 1855: Geol. Sur. Missouri, Ann. Rept., p. 201, pl. E, fig. 10.

Productus cora Marcou, 1858: Geol. N. A., pl. vi, figs. 4-4a.

Productus flemingi Geinitz, 1866: Carb. und Dyas in Nebraska, p. 52, tab. iv, figs. 1, 2, 3, 4.

Productus calhounianus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 51. (Not Swallow, 1858.)

Productus koninckianus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 53, tab. iv, fig. 4. (Not de Verneuil, 1845.)

Productus prattenianus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 163, pl. ii, figs. 5a-c; pl. v, figs. 1-3, pl. viii, figs. 10a-b.

Productus prattenianus White, 1875: U. S. Geol. Sur. w. 100 Merid., vol. IV, p. 113, pl. vii, figs. 10a-c.

Productus cora White, 1884: Geol. Sur. Indiana, Ann. Rep. 1883, p. 126, pl. xxvi, figs. 1, 2, 3.

Productus cora Keyes, 1888: Proc. Acad. Nat Sci., Phila., p. 227.

Shell of medium size, regularly rounded anteriorly, as long as wide, length of hinge-line equal to greatest breadth. Ventral valve regularly arched, with no medial sinus; umbonal region more or less gibbous; beak incurved; ears rather large, somewhat compressed, with a few well-marked wrinkles. Dorsal valve decidedly concave, slightly flattened posteriorly. Surface marked by numerous fine, radiating costæ, and on the ventral side by a few scattered spines.

Horizon and localities.—Upper Carboniferous, Coal Measures: Calhoun (Henry county), Kansas City.

Productus cora was originally described from South America; while in North America the same form has been given, at

various times, a variety of names, White, who has carefully examined specimens from the type locality, has no hesitation in referring the shell commonly called *P. pratteniarus* to d'Orbigny's species. Until quite recently no American writers, with the exceptions of Owen and Marcou, noted the identity of the two shells. It would appear, therefore, that *P. pratteniarus* Norwood & Pratten is actually a synonym of *P. cora*; as is probably also *P. hildrethianus* of the same authors. The other titles given in the synonymy have already been discussed at length by Meek.

Productus symmetricus McChesney.

Plate xxxvi, figs. 2a-b.

Productus symmetricus McChesney, 1860: Desc. New Pal. Foss., p. 35.
Productus symmetricus McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 25, pl. i, figs. 9a-b.
Productus symmetricus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 167, pl. v, figs. 6a-b; pl. viii, fig. 13.

Similar to *P. nebrascensis*, but somewhat flatter; no mesial sinus; concentric folds much smaller, spines fewer, in single instead of double rows.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Productus nebrascensis Owen.

Plate xxxvii, figs. 3a-c.

Productus nebrascensis Owen, 1852: Geol. Sur. Iowa, Wisconsin and Minnesota, p. 584, pl. v, fig. 3.
Productus rogersi Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 9, pl. i, figs. 3a-c.
Productus rogersi Hall, 1856: Pacific R. R. Rept., vol. III, p. 104, pl. ii, figs. 14, 15.
Productus norwoodi Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 182.
Productus asper McChesney, 1860: Desc. New Pal. Foss., p. 34.
Productus wilberanus McChesney, 1860: Desc. New Pal. Foss., p. 36.
Strophalosia horrescens Geinitz, 1866: Carb. und Dyas in Nebraska, p. 81. (Not Murchison.)
Productus nebrascensis McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 24, pl. i, fig. 7.
Productus wilberanus McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 28, pl. i, fig. 8.

Productus nebrascensis Meek, 1872: U. S. Geol. Sur. Nebraska, p. 165, pl. ii, fig. 2, ; pl. iv, fig. 6; pl. v, figs. 11a–c.
Productus nebrascensis White, 1875: U. S. Geog. Sur. w. 100 Merid., vol. IV, pt. ii, p. 116, pl. viii, figs. 3a-d.

Shell rather below medium size, slightly wider than long; cardinal margin about equal to greatest breadth. Ventral valve moderately arched, most abruptly curved toward the beak, which is incurved and extended beyond the hinge-line; mesial sinus shallow. Dorsal valve flattened centrally, concave toward the margins. Surface marked by broad, concentric wrinkles, and obscure, interrupted radiating costæ, set with numerous short, stout spines, with fewer long ones interspersed.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

This is one of the most abundant and characteristic species of this genus occurring in the Coal Measures of the Mississippi basin. Although the original figures of Owen are defective and misleading in many particulars, there is now no doubt as to the identity of this species from the various localities in the state.

Norwood & Pratten's *P. rogersi* described from Huntsville, Missouri, is apparently an internal cast of the shell under consideration, in which the radiating ribs and concentric folds are very prominently marked. The forms described by McChesney as *P. asper* and *P. wilberanus* are manifestly merely local varieties of typical *P. nebrascensis*, as a careful comparison and examination of a large series of specimens has recently shown.

As to Geinitz's determinations of this form in the Carbonformation und Dyas in Nebraska, Meek says substantially as follows: Geinitz was certainly in error in referring this shell to *Strophalosia horrescens*, since it is positively not a Strophalosia at all, but a true Productus, as may be seen from any well-preserved specimens. It never has any traces of the cardinal area of the genus Strophalosia, as has been well shown in the careful examination of hundreds of good specimens, its cardinal margin being linear. By a comparison with *Strophalosia horrescens*, as illustrated in Geinitz's work on the German Per-

mian fossils (Dyas), the external difference between this genus and Strophalosia will be at once seen, the latter genus having a cardinal area. The presence of an area alone, however, is not always a sufficient distinction, since there is, in some very rare instances, an abnormally developed area in true Productus. The total absence of cardinal teeth and sockets, however, in the latter genus, clearly separates these types. That P. *nebrascensis* is entirely destitute of any traces of hinge teeth is well known to all who have examined the interior of this shell.

Productus semireticulatus (Martin).

Plate xxxvi, figs. 4a-c.

Productus semireticulatus Martin, 1809: Petref. Derb., p. 7, pl. xxxii, figs. 1, 2; pl. xxxiii, fig. 4.

Productus semireticulatus DeKoninck, 1844: Monog. Gen. Productus, pl. 8, fig. 1.

Productus calhounianus Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 181.

Productus magnicostatus Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 641.

Productus semireticulatus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 160, pl. v, figs. 7a-b.

Productus semireticulatus White, 1875: U. S. Geog. Sur. w. 100 Merid, vol. IV, pt. ii, p. 111, pl. viii, figs. 1a-c.

Shell rather large, wider than long; hinge-line equal to greatest breadth of valves. Ventral valve very convex, strongly incurved, with a broad, rounded, mesial sinus; beak prominent, closely incurved; ears well defined. Dorsal valve flattened more or less, curved toward the anterior margin. Surface of both valves marked by strong, rounded, radiating ribs, some of which bifurcate; in the visceral region these are crossed by many concentric folds. Spines stout, few and scattered.

Horizon and localities.—Upper Carboniferous. Upper Coal Measures: Creighton (Cass county), Calhoun (Henry county).

Productus punctatus (MARTIN).

Plate xxxvii, figs. 1a-c.

Anomites punctatus Martin, 1809: Petref. Derb., pl. xxxvii, fig. 6.
Productus punctatus Sowerby, 1822: Min. Conch., p. 22, pl. cccxiii.
Productus semipunctatus Shephard, 1838: Am. Jour. Sci., vol. XXXIV, p. 153, fig. 9.
Productus tubulospinus McChesney, 1860: Desc. New Pal. Foss., p. 37.
Productus punctatus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 169, pl. 2, fig. 6, pl. iv, fig. 5.
Productus punctatus White, 1875: U. S. Geol. Sur. W. 100 Merid., vol. IV, pt. ii, p. 114, pl. vii, figs. 2a-c.

Shell large, thin, somewhat ovate; hinge-line considerably shorter than the greatest width of the valves. Ventral valve more or less strongly arched, with a broad shallow mesial sinus; beak incurved; ears not well defined. Dorsal valve slightly concave with a low median ridge. Surface marked by numerous well defined concentric ridges, upon which are arranged many small spines.

Horizon and localities —Upper Carboniferous, Upper Coal Measures: Kansas City.

Productus costatus SOWERBY.

Plate xxxvi, figs. 1a-c.

Producta costata Sowerby, 1827: Min. Conch, vol. VI, p. 115, pl. clx.
Productus portlockianus Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 15, pl. i, figs. 9a-c.
Productus costatus Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 216.
Productus costatus Hall, 1858: Geol. Sur. Iowa, vol. I, p. 712, pl. xxviii, figs. 3, 4.
Productus costatus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 159, pl. vi, figs. 6a-b.
Productus costatus White, 1875: U. S. Geog. Sur. 100 Merid, vol. IV., pt. ii, p. 109, pl. viii, figs. 2a-d

Shell much like *P. semireticulatus,* but rather smaller, less robust, mesial sinus more pronounced, and radiating costæ less regular.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

As remarked by Meek this shell has been so generally designated under Sowerby's title, that notwithstanding the perhaps

questionable identity with the typical *P. costatus*, it seems inadvisable to make any nominal changes until careful and complete comparisons have been instituted. The form appears to be closely related to Martin's *P. semireticulatus*; and eventually may prove to be merely the young of that species. *P. portlockianus*, described by Norwood & Pratten from Carbonaire, is regarded merely as an unimportant local variation of the species. Like all the Carboniferous Producti, this shell has a wide geographical range and quite an extensive distribution in time.

Productella subalata (Hall).

Productus subalatus Hall, 1857: 10th Rep. N. Y. State Mus. Nat. Hist., p. 174.

Productus subalatus Hall, 1858: Geology Iowa, vol. I, p. 500, pl. iii, figs. 10a–c.

Very closely related to and perhaps identical with *P. pyxidata.*

Horizon and localities.—Devonian, Callaway limestone: Callaway county.

Productella pyxidata (Hall).

Plate xxxviii, figs. 1a-d.

Productus pyxidatus Hall, 1858: Geology Iowa, vol. I, p. 498, pl. iii, figs. 8a-e.

Productus shumardianus Hall, 1858: Geology Iowa, vol. I, p. 499, pl. vii, fig. 2.

Shell rather large (for the genus), wider than long; cardinal extremities rounded; hinge-line usually shorter than greatest width of shell; surface differing from a Productus in being smooth, with concentric often imbricating lines of growth and long spines, few in number. Often low, indistinct radiating ridges are discernible.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Louisiana, Hannibal, Clarksville (Pike county).

Chonetes geniculatus WHITE.

Plate xxxviii, fig. 8

Chonetes geniculatus White, 1862: Proc. Boston Soc. Nat. Hist., vol. IX, p. 29.

A small form with fine radiating lines.

Horizon and localities.—Lower Carboniferous, Louisiana (Kinderhook?) limestone: Louisiana, Clarksville.

Chonetes ornata SHUMARD.

Plate xxxviii, fig. 9.

Chonetes ornata Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 202, pl. C, figs. 1a–c.

Resembling somewhat *C. flemingi*, but having much coarser radiating costæ.

Horizon and localities.—Lower Carboniferous, Kinderkook beds: Hannibal, Louisiana, Vandever Falls (Cooper county).

Chonetes logani NORWOOD & PRATTEN.

Chonetes logani Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila.

A small, semielliptic form with rather coarse, radiating lines.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal, Louisiana.

Chonetes illinoisensis WORTHEN.

Chonetes logani Hall, 1858: Geology Iowa, vol. I, p. 598, pl. xii, figs. 1a-b.

Chonetes illinoisensis Worthen, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 571.

Chonetes illinoisensis Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 505, pl. xv, figs. 8a-b.

Somewhat resembling *C. logani*, but larger, and with about four times as many radiating lines.

Horizon and localities.—Lower Carboniferous, Lower Burlington limestone: Louisiana, Ash Grove (Greene county).

Chonetes mesoloba NORWOOD & PRATTEN.

Chonetes mesoloba Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 27, pl. ii, figs. 7a–c.

Chonetes mesoloba White, 1875: U. S. Geog. Sur. w. 100 merid., vol. IV, pt. ii, p. 123, pl. ix, figs. 7a.

Chonetes mesoloba Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 228.

Shell like *Ch. granulifera* but very much smaller, and having in the ventral valve a prominent mesial fold with a narrow and deep furrow on each side.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Chonetes millepunctatus MEEK & WORTHEN.

Chonetes millepunctatus Meek & Worthen, 1870: Proc. Acad. Nat. Sci., Phila., p. 35

Chonetes millepunctatus Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, pl. xxv, figs. 3a–b.

Shell large, thin, about two and one half times as wide as high. Dorsal valve almost flat, or slightly concave; hinge-line slightly shorter than the greatest width of the shell; extremities rounded; cardinal process stout; cardinal edge somewhat thickened within, forming an obscure ridge which reaches half way to the extremities. Surface marked by numerous closely arranged concentric costæ, which are very regular.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Kansas City.

Chonetes flemingi NORWOOD & PRATTEN.

Plate xxxviii, figs. 6a–b.

Chonetes flemingi Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 26, pl. ii, figs. 5a–e.

Chonetes verneuiliana Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 26, pl. ii, figs. 6a–c.

Chonetes parva Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 201.

Chonetes verneuiliana Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 216.

Chonetes verneuiliana Meek, 1872: U. S. Geol. Sur. Nebraska, p. 170, pl. i, figs. 10a–b.

Chonetes flemingi Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 247.

Shell similar to *Ch. granulifera*, but more convex, much smaller, with mesial sinus of the ventral valve very marked.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Chonetes lævis KEYES.

Plate xxxvii, figs. 5a-b.

Chonetes glabra Geinitz, 1866: Carb. und Dyas in Nebraska, p. 60, tab. iv, figs. 15-18. (Not Hall, 1857.)
Chonetes glabra Meek, 1872: U. S. Geol. Sur. Nebraska, p. 171, pl. iv, fig. 10; and pl. viii, figs. 8a-b.
Chonetes lævis Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 229, pl. xii, figs. 3a-b.
Chonetes geinitzianus Miller, 1890: N. A. Geol. and Pal., p. 339.
Chonetes lævis Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 246.

Shell small, thin, transversely semi-elliptic; hinge-line as long as the greatest width of the shell, or often extended beyond the lateral margins. Ventral valve convex, with a broad, very shallow median depression, which is often wanting entirely; beak not prominent, appressed; cardinal area rather narrow but well defined centrally, becoming linear toward the extremities; foramen moderately wide; cardinal margin bearing from four to seven oblique spines on each side of the beak. Dorsal valve flat, or slightly concave; cardinal process small and slightly trilobate. Surface of shell apparently smooth, but under a magnifier it is seen to be marked by numerous very minute concentric lines and more prominent, often somewhat imbricated, lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

In the original diagnosis of this species the statement was made that the form was probably the same as that described by Geinitz as *Chonetes glabra* from the Upper Coal Measures of Nebraska. But inasmuch as Geinitz's name had been preoccupied by Hall in 1857 for a species from the Upper Helderberg, *Chonetes lævis* becomes the next available name. Miller, however, has proposed still more recently the term *Chonetes geinitzianus* for the same shell, which of course becomes a synonym.

Lately this form has been found in great abundance in central Iowa scattered through a bed of bituminous shale near Des Moines. It is associated with its near congener *Ch. mesoloba* Norwood & Pratten. The differences between the two species,

as pointed out in the remarks accompanying the description of *Ch. lævis*, hold good throughout the entire series collected. As some of the specimens of the smooth species often show faint radiating striæ, it has been suggested that these shells are merely water-worn individuals of other forms. This, however, does not appear to be the case, as a large number of both species have been found intimately associated; and in *Ch. mesoloba* the radiating striæ are very sharply defined and well preserved. Besides, the conditions under which the mollusks of these species flourished show conclusively that all influences of wave action were absent during the deposition of the deposits.

Chonetes granulifera Owen.

Chonetes granulifera Owen, 1852: Geol. Sur. Wisconsin, Iowa and Minnesota, p. 583, tab. v, figs. 12a–c.

Chonetes granulifera Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., vol. III, p. 24.

Chonetes smithii Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., vol. III, p. 24, pl. ii, figs. 2a-c.

Chonetes mucronata Meek & Hayden, 1858: Proc. Acad. Nat. Sci., Phila., p. 262. (Not Conrad, 1843.)

Chonetes mucronata Meek & Hayden, 1864: Pal. Upper Missouri, p. 22, pl. i, figs. 5a–e.

Chonetes mucronata Geinitz, 1866: Carb. und Dyas in Nebraska, p. 58, tab. iv, figs. 12, 13, 14.

Chonetes granulifera Meek, 1872: U. S. Geol. Sur. Nebraska, p. 170, pl. iv, fig. 9, pl. vi, fig. 10; pl. viii, fig. 7.

Chonetes granulifera White, 1875: Expl. and Sur. w. 100 Merid, vol. IV, pt. ii, p. 122, pl. ix, figs. 8a.–c.

Shell rather large, semicircular; hinge-line longer than greatest breadth of shell anteriorly. Ventral valve regularly convex, with the mesial sinus broad yet shallow; beak small, extending but slightly over the hinge area; cardinal margig provided with from seven to ten spines on each side of the beak. Area narrow, with a wide foramen which is partially covered by a pseudo-deltidium. Hinge teeth well defined, narrow, finely lined. Dorsal valve concave, rather closely appressed against the opposite valve. Surface of shell marked by numerous fine, radiating ribs, with a few concentric lines of growth which are usually more or less imbricated.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

This widely distributed form is quite abundant everywhere along the Missouri river in Missouri, Kansas, Nebraska and Iowa, and forms one of the most characteristic species of the Upper Coal Measures. *Chonetes mucronata*, described by Meek & Hayden, is manifestly the same species with the hinge-line somewhat more extended than in Owen's specimens. *Chonetes smithi* of Norwood and Pratten appears, in all essential respects, identical with the species under consideration.

Orthis occidentalis Hall.

Orthis occidentalis Hall, 1847: Pal. New York, vol. I, p. 127, pl. xxxii A, figs. 2a–m.
Orthis occidentalis Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 96, pl. ix, figs. 3a–h.
Orthis occidentalis White, 1881: Geol. Sur. Indiana, 10th Ann. Rep., p. 485, pl. ii, figs. 10–12.

Shell of moderate size, somewhat wider than long, transversely subquadrate. Surface ornamented by coarse costæ.

Horizon and localities.—Lower Silurian, Trenton limestone: Cape Girardeau.

Orthis fissicosta Hall.

Orthis fissicosta Hall, 1847: Pal. New York, vol. I, p. 121, pl. xxxii, figs. 7a–b.
Orthis fissicosta Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 106, pl. viii, figs. 6a–h.

Like *O. retrorsa* but much smaller, and with fewer and proportionally much larger radiating costæ.

Horizon and localities.— Lower Silurian, Trenton limestone: McCune station (Pike county), Cape Girardeau.

Orthis emacerata Hall.

Orthis emacerata Hall, 1860: 13th Reg. Rep. St. Cab. New York, p. 121.
Orthis emacerata Hall, 1862: 15th Reg. Rep. St. Cab. New York, pl. ii, figs. 1-2.
Orthis emacerata Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 109, pl. viii, figs. 1a-d and 2a-g.

Shell small, plano-convex, rather depressed, transversely truncato-suboval, the length being about five-sixths its breadth; hinge-line perhaps always a little shorter than the greatest breadth of the valves; lateral margins generally rounding to the hinge, most prominent at or a little behind the middle, and rounding to the front, which is usually somewhat straightened, or very faintly sinuous, at the middle; or presents a regular semicircular outline. Dorsal valve nearly flat, or slightly convex on each side of a shallow mesial sinus, that commences very narrow at the beak, and usually widens rather rapidly to the front; beak very small, scarcely projecting beyond the edge of the area, and not incurved; area low at the middle, and narrowing off to nothing at the lateral extremities of the hinge, slightly arched, and directed obliquely backward; forearm very small and filled by the cardinal process. Interior very shallow, and provided with a slender mesial ridge that extends about half way forward from the hinge, between the muscular impressions, which are not usually well defined; scars of posterior pair of adductor muscles smaller, and usually deeper, than the interior, and situated close back under the brachial processes; those of the anterior pair three or four times the size of the posterior, sub-oval in form, and extending to near the middle of the valve; cardinal process very small and trifid; brachial processes comparatively rather stout and prominent; internal surface having the radiating striæ of the exterior rather distinctly impressed through as it were, in consequence of the thinness of the shell, and finely granular, the granules being apparently connected with the punctate structure of the shell.

Ventral valve compressed, convex, the greatest convexity being near or a little behind the middle, along a more or less

prominent undefined ridge that sometimes, but not always, imparts a sub-carinate appearance to the central and umbonal regions; beak small, projecting somewhat beyond that of the other valve; abruptly pointed and rather distinctly arched, but not strongly incurved; area about twice as high as that of the other valve, and with its sharply defined edges sloping to the lateral extremities of the hinge, directed and arched obliquely backward with the beak; foramen having nearly the form of an equilateral triangle, but rather narrowed upward to the apex of the beak, and partly occupied by the cardinal process of the other valve. Interior showing the teeth to be moderately prominent; concavity for the muscular impressions very shallow, small, somewhat bifid anteriorly, and not defined by a very distinct marginal ridge; scars of divaricator muscles apparently narrow, and situated on each side of a shallow mesial depression, which seems to include far back at its posterior end those of the very small adductors, merely separated from each other by a hair line; impressions of ventral adjustor muscles apparently wider and shorter than those of the divaricators; striæ and the fine granules of the interior as in the other valve.

Surface of both valves ornamented by numerous distinct radiating striæ, that usually bifurcate about three times between the beak and free margins; posterior lateral striæ so strongly curved that a part of them run out on the hinge-line. Numerous very minute, regularly disposed concentric lines may also be seen by the aid of a magnifier, most distinctly defined in the furrows between the much larger radiating striæ; while a few distant, subimbricating, stronger marks of growth are usually seen in adult shells. (Meek.)

Horizon and localities.—Lower Silurian, Hudson shales: Cape Girardeau.

Orthis tricenaria CONRAD.

Plate xxxix, fig. 4.

Orthis tricenaria Conrad, 1843: Proc. Acad. Nat. Sci., Phila., p. 333.
Orthis tricenaria Hall, 1847: Pal. N. Y., vol. I, p. 121.

Shell rather below medium size, flattened, sides straight, hinge-line as long as greatest width. Surface marked by strong, rather large radiating costæ, which curve slightly outward as they leave the beak.

Horizon and localities.—Lower Silurian, Hudson shales: McCune station (Pike county).

Orthis missouriensis SHUMARD.

Orthis missouriensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 205, pl. C, figs. 9a-b.

Like *O. tricenaria*, but much wider in proportion to the length; hinge-line also longer than greatest width.

Horizon and localities.—Lower Silurian, Girardeau limestone: Cape Girardeau.

Orthis subquadrata HALL.

Orthis subquadrata Hall, 1847: Pal. New York, vol. I, p. 126, pl. xxxiiA, figs. 1a-o.
Orthis subquadrata Hall, 1862: Geol. Sur. Wisconsin, Ann. Rept., p. 54.
Orthis subquadrata Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 94, pl. ix, figs. 2b-g.

Shell attaining about a medium size, rather distinctly resupinate, somewhat wider than long, subquadrate in general outline; moderately convex; cardinal margin shorter than the breadth of the valves, and rounding abruptly at the extremities into the lateral margins, which round and converge forward; front a little sinuous or straightened at the middle.

Dorsal valve more convex than the other, its most prominent part being near the middle; mesial sinus small and rather shallow, sometimes continued back nearly to the umbo, or in other instances scarcely more than reaching the middle; beak very short, or little distinct from the edge of the area, and more or less arched; area narrow, directed obliquely backward and downward. Interior with scars of the adductor muscles moderately distinct, the posterior pair being situated close

back under the brachial processes, one on each side of a well-defined rounded ridge, that becomes suddenly smaller between the anterior pair; cardinal process rhombic, subconical, moderately prominent, and having its posterior side marked by deeply impressed divaricating striæ; sockets well defined; brachial process rather strong, and directed obliquely forward and laterally; internal surface, excepting the radiately striated front and lateral margins, nearly smooth.

Ventral valve a little convex at the umbo, and flat or slightly concave between the umbo and the front and lateral margins, but sometimes having a low, very obscure mesial elevation toward the front; beak small and very short, or scarcely equaling that of the other valve, arched at the apex, but not strongly incurved; area about twice as high as that of the other valve; well-defined, tapering rather rapidly toward the lateral extremities, arched with the beak and directed backward and downward at decidedly less than a right angle to that of the other valve; foramen broad-triangular, and partly occupied by the cardinal process of the other valve. Interior with muscular scars occupying a rather deep bilobate impression, extending nearly or quite to the middle of the valve, and usually defined by a low ridge most distinct on each side; scars of adductor muscles small, separated by a mere trace of a raised line; those of the divaricator muscles of moderate size, longitudinally striated, and having their narrow posterior ends extending backward nearly to a small triangular, transversely striated space occupying the interior of the beak; those of the ventral adjustor muscles smaller and shorter than the divaricators, and situated nearly under the hinge teeth, which are moderately prominent, sub-trigonal and oblique; vascular markings with their lateral divisions curving up backward and sending off several branches, while the other divisions extend forward and bifurcate so as to occupy the anterior region; anterior and lateral margins crenate within by very short striæ.

Surface of both valves ornamented by moderately stout, radiating striæ, the posterior lateral of which curve so strongly

outward that a few of them run out on the cardinal edge before reaching the lateral margins; striæ of the ventral valve nearly always increasing by bifurcation (some of them dividing two or three times), while that on the dorsal valve generally increases by the intercalation of shorter ones between the longer. A few distant sub-imbricating marks of growth are sometimes seen toward the front and lateral margins; while on perfectly preserved specimens the radiating striæ may sometimes be seen to be roughened by minute elevated concentric lines, that are more or less interrupted in crossing some of the striæ.

Horizon and localities—Lower Silurian, Hudson shales: Warren and Jefferson counties.

Orthis subcarinata HALL.

Orthis subcarinata Hall, 1857: Reg. Rep. Univ. New York, p. 43.
Orthis subcarinata Hall, 1859: Pal. New York, vol. III, p. 169, pl. xii, figs. 7-21.
Orthis subcarinata Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 373, pl. vii, figs. 6a-d.

A rather small subovate form resembling *O. elegantula.*

Horizon and localities.—Upper Silurian limestone: Cyrene (Pike county), Bailey landing (Perry county).

Orthis iowensis HALL.

Plate xxxviii, figs. 6a-c.

Orthis iowensis Hall, 1858: Geology Iowa, vol. I, p. 488, pl. ii, figs. 4a-i.
Orthis iowensis White, 1881: Geol. Sur. Indiana, 10th Ann. Rept., p. 501, pl. v, figs. 10-12.

Shell transversely ovoid; hinge-line short, about one-half the width of the valves. Ventral valve much deeper than the dorsal, with a broad median fold; beak prominent, area small. Dorsal valve flattened, with a broad shallow sinus. Surface marked by fine radiating lines.

Horizon and localities. — Devonian, Hamilton limestone: "Grand Tower" (Perry county).

Orthis swallowi Hall.

Plate xxxviii, fig. 5.

Orthis swallowi Hall, 1858: Geology Iowa, vol. I, p. 597, pl. xii, figs. 5a-b.

Orthis clarkensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 81.

Shell very large, wider than long; hinge-line long, but somewhat shorter than greatest width of the valves; cardinal extremities rounded. Dorsal valve quite convex, with occasionally obscure traces of a mesial sinus. Surface marked by numerous closely arranged radiating lines and concentric lines of growth.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal.

Orthis burlingtonensis Hall.

Plate xxxviii, fig. 7.

Orthis michelina, var. *burlingtonensis* Hall, 1858: Geology Iowa, vol. I, p. 596, pl. xii, figs. 4a-b.

Orthis thiemei White, 1860: Jour. Boston Soc. Nat. Hist., vol. VII, p. 231.

Orthis missouriensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. I, p. 639. (Not Shumard 1855.)

Orthis thiemei White, 1883: U. S. Geol. and Geog. Sur. Terr., 12th Ann. Rep., p. 164, pl. xii, figs. 4a-d.

Shell rather small, appressed, subcircular, hinge-line rather short. Dorsal valve somewhat deeper than the ventral. Surface of both valves marked by fine radiating costæ.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Louisiana, Hannibal; Burlington (Iowa); Burlington limestone: Sedalia, Ash Grove (Greene county), Springfield, Hannibal, Louisiana, Ste. Genevieve.

Orthis keokuk Hall.

Orthis keokuk Hall, 1858: Geology Iowa, vol. I, p. 640, pl. xix, figs. 5a-b.

Very large, with small radiating costæ.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Wayland (Clark county).

Orthis dubia Hall.

Orthis dubia Hall, 1856: Trans. Albany Inst., vol IV, p. 12.
Orthis cooperensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 82.
Orthis dubia Whitfield, 1882: Bul. American Mus. Nat. Hist., No. 3, p. 45, pl. vi, figs. 1-5.
Orthis dubia Hall, 1883: Geol. Sur. Indiana, 12th Ann. Rept., p. 324, pl. xix, figs. 1-5.

Similar to *O. burlingtonensis* but very much smaller.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett (St. Louis county).

Orthis pecosii Marcou.

Orthis pecosii Marcou, 1858: Geol. N. A., p. 48, pl. vi, figs. 14a–b.
Orthis carbonaria Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 218.
Orthis carbonaria Meek, 1872: U. S. Geol. Sur. Nebraka, p. 173, pl. i, figs. 8a–c.
Orthis pecosii White, 1875: U. S. Geog. Sur. w. 100 Merid., vol. IV, p. 125, pl. ix, figs. 5a–c.

Shell small, sub-circular in outline; hinge-line short. Ventral valve moderately convex, more or less distinctly flattened anteriorly; beak small, rather prominent, pointed, and arched over the small well-marked area; foramen narrow. Dorsal valve usually slightly more arched than the opposite valve, and generally showing traces of a very shallow median sinus; area well defined, but smaller than in the other valve. Surface marked by numerous fine radiating ribs, which increase by intercalation; these are crossed by lines of growth.

Horizon and localities—Upper Carboniferous, Coal Measures: Kansas City.

Platystrophia lynx (Eichwald).

Plate xxxix, fig. 5.

Terebratula lynx Eichwald, 1830: Nat. Kizze. von Podol, p. 202.
Spirifer lynx Von Buch, 1837: Ueber Delth., p. 44.
Spirifer biforatus, var. *lynx* Hall, 1852: Pal. New York, vol. II, p. 65, pl. xxii, figs. 1a-e.
Orthis lynx Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 114, pl. x, figs. 1a-e.

Shell attaining a large size, nearly equivalve, wider than long, with a transversely oval sub-quadrate outline, or, in old

specimens, often becoming so gibbous as to assume a sub-globose form; hinge-line usually a little less than the greatest breadth of the valves but sometimes equaling, or somewhat exceeding, the same; cardinal extremities more or less obtusely angular, nearly rectangular, or sometimes rather sinuous behind and rounding to the front, which is a little sinuous, rounded or somewhat prominent at the middle; beaks and cardinal areas of the two valves nearly equal, the former incurved and approximate, or, in adult shells, sometimes contiguous. Dorsal valve generally a little more convex than the other, in some examples rather decidedly so (its greatest convexity being near the middle), provided with a moderately prominent, rather rounded mesial fold, that commences at or near the beak, and continues forward, gradually widening and rounding over with the curve of the valve to the front, where it is moderately elevated, with more or less sloping sides; lateral slopes convex; beak projecting beyond the hinge margin, strongly incurved, particularly in old individuals, which sometimes have the gibbous umbo projecting even a little beyond that of the other valve; cardinal area well developed, distinctly defined, nearly as wide as that of the other valve, directed backward, and more or less strongly incurved; foramen broad-triangular, and not closed by the cardinal process. Interior showing the cardinal process to be very small, or merely having the character of a low linear ridge in the rostral cavity; posterior pair of muscular impressions corrugated, and decidedly larger and more widely separated than the others.

Ventral valve with a mesial sinus corresponding to the fold in the other valve, and terminating at the front in a rather short, somewhat rounded projection, that curves more or less upward into a sinuosity of the same size and form in the margin of the dorsal valve; beak usually a little less strongly incurved than that of the other, and very slightly more prominent at its apex; cardinal area about one-fourth to one-third higher at the middle than in the dorsal valve, and narrowing less rapidly toward the lateral extremities; incurved and directed backward, but a little less strongly so than the other;

foramen having nearly the form of an equilateral triangle, or sometimes slightly wider than high, or the reverse. Interior with hinge teeth moderately prominent and trigonal; cavity for the reception of the muscular attachments comparatively small, scarcely reaching the middle of the valve, longer than wide, or elongate-oval, with nearly straight and parallel sides, always well defined by the dental ridges, and on old specimens extremely profound, owing to the thickening of the interior of the cardinal region of the valve on each side.

Surface of each valve ornamented by about sixteen to twenty-four strong, more or less angular radiating plications, of which three or four (rarely five) occupy the mesial sinus, and from four to six the mesial fold; plications generally simple, but occasionally some of those in the sinus and on the fold, and still more rarely, a few of those on the lateral slopes, bifurcating oñce; lines of growth moderately distinct, particularly near the free margins of adult shells, where they present a distinctly zigzag appearance in crossing the plications and the furrows between them. Protected portions of the surface of well-preserved specimens also often show, under a strong magnifier, numerous regularly arranged minute granules, probably coincident with the punctures of the shell substance. (Meek.)

Horizon and localities.—Lower Silurian, Trenton limestone: Cape Girardeau.

Platystrophia acutilirata (Conrad).

Delthyris acutilirata Conrad, 1842: Jour. Acad. Nat. Sci., Phila., vol. VII, p. 260, pl. xiv, fig. 15.

Orthis acutilirata Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 119, pl. x, figs. 5a-g.

Like *P. lynx* but with hinge-line extended, often making the shell twice as wide as long.

Horizon and localities.—Lower Silurian, Hudson shales: Louisiana.

Streptorhynchus filitexta (HALL).

Leptæna filitexta Hall, 1847: Pal. New York, vol. I, p. 111, pl. xxxiB, figs. 3a-f.
Strophomena filitexta Hall, 1859: 12th Rep. Reg. State Cab. New York, p. 70.
Strophomena filitexta Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 83, pl. vi, figs. 5a-d.

Like *S. planumbonum* but longer, and ornamented with much finer radiating lines.

Horizon and localities.—Lower Silurian, Hudson shales: Louisiana.

Streptorhynchus subplanum (CONRAD).

Strophomena subplana Conrad, 1842: Jour. Acad. Nat. Sci., Phila., vol. VIII, p. 258.
Leptæna subplana Hall, 1852: Pal. New York, vol. II, p. 259, pl. liii, figs. 8-10.
Streptorhynchus subplana Hall, 1863: Trans. Albany Institute, vol. IV, p. 226.
Streptorhynchus subplana Hall, 1882: Geol. Sur. Indiana, 11th Ann. Rept.

Somewhat like *S. planumbonum* but flat, larger, and with much coarser radiating costæ.

Horizon and localities.—Upper Silurian limestone: Cyrene (Pike county).

Streptorhynchus lens WHITE.

Plate xxxix, figs. 2a-b.

Streptorhynchus lens White, 1862: Proc. Boston Soc. Nat. Hist., vol. IX, p. 28.

A small circular form with narrow cardinal areas.

Horizon and localities. — Lower Carboniferous, Louisiana (Kinderhook?) limestone: Louisiana, Clarksville.

Streptorhynchus crenistria (PHILLIPS).

Plate xxxviii, figs. 8a-h.

Spirifera crenistria Phillips, 1836: Geol. Yorkshire, vol. II, p. 216, pl. ix, fig. 6.
Producta incurvata Shepard, 1838: Am. Jour. Sci., p. 144, figs. 1, 2, 3.
Orthisina crassa Meek & Hayden, 1858: Proc. Acad. Nat. Sci., Phila., p. 260.
Orthis robusta Hall, 1858: Geol. Iowa, vol. I, p. 713, pl. xxviii, figs. 5a-c.
Orthis lasallensis McChesney, 1860: Desc. New Palæ. Foss., p. 32.

Orthis richmonda McChesney, 1860: Desc. New Palæ. Foss., p. 32.
Hemipronites crassus Meek & Hayden, 1864: Palæ. Upper Missouri, p. 26, pl. i, figs. 7a-d.
Orthis crenistria Geinitz, 1866: Carb. und Dyas in Nebraska, p. 46, tab. iii, figs. 20, 21.
Hemipronites lasallensis McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 28, pl. i, fig. 6.
Hemipronites crassus McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 28, pl. i, fig. 5.
Hemipronites crassus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 174, pl. v, figs. 10a-b; and pl. viii, fig. 1.
Hemipronites crassus Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 570, pl. xxv, fig. 12.
Hemipronites crenistria White, 1875: U. S. Geog. Sur. w. 100 Merid., vol. IV, p. 124, pl. x, fig. 9a.
Hemipronites crassus White, 1884: Geol. Sur. Indiana, Rep. 1883, p. 129, pl. xxvi, figs. 4-11.
Streptorhynchus crenistria Keyes, 1888: Proc. Acad. Nat. Sci., Phila, p. 229.

Shell quite variable, semi-circular to nearly round in outline, generally, however, considerably wider than long; hinge-line usually shorter than the greatest breadth of the valves. Dorsal valve moderately convex; beak not distinct. Ventral valve convex at first, but becoming flat and then sometimes concave around the anterior margin; hinge-area varying considerably in height; plane? or slightly concave, more or less distinctly marked by fine lines; foramen closed. Surface ornamented by numerous fine radiating ribs, of which every fourth or fifth is much more prominent than the rest; these are crossed by fine lines of growth.

Horizon and localities.—Upper Carboniferous, Coal Measures: Kansas City, Clinton, Lexington.

Meekella striatocostata (Cox)

Plate xxxix, figs. 1a-c.

Plicatula striatocostata Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 568, pl. viii, fig. 7.
Orthisina shumardiana Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 183.
Orthisina missouriensis Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 219.
Streptorhynchus pyramidalis Newberry, 1861: Ives' Exp. Exped. Colorado River, p. 126

Streptorhynchus occidentalis Newberry, 1861: Ives' Exp. Exped. Colorado River, p. 126.
Orthisina occidentalis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 83.
Orthis striatocostata Geinitz, 1866: Carb. und Dyas in Nebraska, p. 48, tab. iii, figs. 22-24.
Meekella striatocostata White & St. John, 1867: Trans. Chicago Acad. Sci., vol. I, p. 120, figs. 4, 5, 6.
Meekella striatocostata Meek, 1872: U. S. Geol. Sur. Nebraska, p. 175, pl. v, figs. 12a-c.
Meekella striatocostata White, 1875: U. S. Geog. Sur. w. 100 Merid., vol. IV, p. 126, pl. ix, figs. 4a-c.

Shell of medium size, subglobose, with from ten to fifteen large radiating plications, which become more or less angular toward the margin; hinge-line much shorter than the greatest breadth of the valves. Ventral valve somewhat larger than the other; cardinal area relatively narrow transversely, often higher than wide, and finely lined; foramen quite narrow, covered by a rounded pseudo-deltidium having a distinct median ridge. The apical portion of the valve is more or less twisted and arched, though occasionally undistorted. Dorsal valve usually less convex than the ventral, often more or less flattened centrally and in front; beak incurved, projecting but slightly beyond the hinge-line. Surface of both valves ornamented by minute radiating lines, which anteriorly converge on each side of the several plications. These are crossed by more or less well-defined lines of growth.

Horizon and localities.—Lower Carboniferous, Upper Coal Measures: Kansas City.

Strophomena deltoidea Conrad.

Strophomena deltoidea Conrad, 1839: Ann. Rept. Geol. New York, p. 64.
Strophomena deltoidea Hall, 1867: Pal. New York, vol. IV, p. 106.

Resembling an immature *S. alternata*, but with the cardinal extremities produced somewhat and the front margin extended.

Horizon and localities.— Lower Silurian, Trenton limestone: McCune station (Pike county).

Plectambonites rhomboidalis (Wilckens).

Plate xxxix, fig. 6.

Conchita rhomboidalis Wilckens, 1769: Nachreicht. von seltenen Verst., p. 77, pl. viii, figs. 43-44.
Strophomena rhomboidalis Lindstrom, 1860: Goth. Brach., p. 371.
Strophomena rhomboidalis Meek, 1873: Geol. Sur. Ohio, vol. I, Pal., p. 75, pl. v, figs. 6a-e.

Like Strophomena but with flattened, visceral area covered with prominent concentric wrinkles, and with abruptly upturned frontal and lateral borders.

Horizon and localities.—Lower Silurian, Hudson shales: Cape Girardeau; Lower Carboniferous, Chouteau (Kinderhook) limestone: Curryville (Pike county); Burlington limestone: Louisiana.

Strophodonta demissa (Conrad).

Plate xxxix, figs. 7a-b.

Strophodonta demissa Conrad, 1842: Jour. Acad. Nat. Sci., Phila., vol. VIII, p. 258, pl. xiv, fig. 14.
Strophodonta demissa Hall, 1857: Reg. Rep. State Cab. Nat. Hist., p. 137.
Strophodonta demissa Hall, 1858: Geology Iowa, vol. I, p. 495, pl. iii, figs. 5a-k.
Strophodonta navalis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 365.
Strophodonta callawayensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 638.
Strophodonta quadrata Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 639.
Strophodonta æquicostata Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 639.

Shell semi-elliptic, about as wide as long; hinge-line usually slightly longer than the greatest width; cardinal area narrow. Surface marked by strong, angular costæ.

Horizon and localities.—Devonian, Callaway limestone: Dauphin (Callaway county).

Strophomena alternata (Conrad).

Plate xxxix, fig. 8.

Leptœna alternata Conrad, 1838: Ann. Rep. Geol. New York, p. 115.
Strophomena alternata Conrad, 1839: Ann. Rep. Geol. New York, p. 62.
Leptœna alternata Hall, 1847: Pal. New York, vol. I, p. 202, pl. xxxi, figs. 10-20.
Strophomena alternata Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 88, pl. vii, figs. 1a-g.

Shell attaining a large size, semi-oval, the breadth being nearly always greater than the length, but varying from about equal to the latter to the proportions of near nine to seven; hinge-line as long at the breadth of the valves at any point farther forward, or somewhat longer; lateral extremities rectangular, sometimes compressed and moderately deflected; lateral margins straight, a little convex, or slightly sinuous posteriorly, and rounding forward to the front, which is semi-circular in outline, or sometimes so prominent and narrowly rounded in the middle as to impart a sub-trigonal form to the general outline of the valves. Dorsal valve flattened in the umbonal and cardinal regions, and gently or more or less strongly concave in the central and anterior portions, and curved upward around the anterior and lateral margins; beak small, but projecting slightly beyond the edge of the area, which is very narrow, or sub-linear, and directed nearly backward. Interior with cardinal process strong directed obliquely forward, with its two divisions distinctly diverging and flattened and longitudinally striated on their posterior faces; sockets for the reception of the teeth of the other valve rather well defined; socket ridges very small, and uniting behind the cardinal process to form a kind of false deltidium; muscular scars comparatively small, but deeply impressed near the cardinal process on each side of a small, short, mesial ridge, and nearly surrounded by a low obtuse ridge formed by the thickening of the adjacent internal surface of the valve; anterior and lateral margins more or less thickened and geniculated within (especially in adult shells), the thickened zone being transversely furrowed and sometimes granular, while outside of it the immediate edge of the valve is suddenly flattened, and minutely striafed and granulated.

Ventral valve a little convex at the umbo, but generally much compressed over the whole visceral region, in the adult (which included the whole surface of the young and half-grown shell), but becoming more convex (sometimes strongly so) anteriorly or anterio-centrally and laterally, and thence more or less curved up to the anterior and lateral margins; area of

moderate height, flat, and directed obliquely backward nearly at right angles to that of the other valve; beak very small, scarcely distinct from the margin of the area, and minutely perforated; foramen broadly triangular, and arched over above by the pseudo-deltidium, which is very deeply sinuous on its inner edge, the sinus being nearly or quite closed by the dental process and pseudo-deltidium of the other valve.

Interior with cardinal margin somewhat carinate within; hinge teeth moderately prominent, remote and widely divergent; dental ridges obscure and extending obliquely outward and forward, but not produced or curving to surround a saucer-shaped cavity for the muscular scars; scars of adductor muscles narrow, long and closely approximated or almost in contact; those of cardinal muscles on each side very large, fan-shaped but shallow, separated sometimes by a small ridge in advance of the adductor scars, and marked by radiating furrows and ridges; while the anterior and lateral regions are usually marked by striæ and scattering granules. Surface of both valves ornamented by numerous radiating striæ, that increase in number, on the ventral valve, mainly by intercalation, and are usually arranged with one to six or eight smaller and shorter ones between each two larger and more prominent ones, the largest one of which often occupies the mesial line; while on the dorsal valve they more frequently increase by division, and are generally of more uniform small size. On well-preserved specimens all the radiating lines are crossed by numerous very minute, regular, closely arranged concentric striæ, that are invisible without the aid of a magnifier; a few moderately distinct, sub-imbricating marks are often seen near the free margins of adult shells. (Meek.)

Horizon and localities.—Lower Silurian, Hudson shales: Cape Girardeau.

Strophomena planumbona (Hall).

Plate xxxix, fig. 3.

Leptœna planumbona Hall, 1847: Pal. New York, vol. I, p. 112, pl. xxx B, figs. 4a-d.

Strophomena planumbona Hall, 1859: 12th Reg. Rep. State Cab. New York, p. 70.

Strophomena planumbona Hall, 1862: Geol. Sur. Wisconsin, p. 54, fig. 7.

Strophomena planumbona Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 79, pl. vi, figs. 3a-h.

Strophomena planumbona White, 1881: Geol. Sur. Indiana, 10th Ann. Rept., p. 480, pl. ii, figs. 13-14.

Shell rather small, or scarcely attaining a medium size, concavo-convex, semi-oval, or more than semicircular in outline; hinge-line generally a little longer than the breadth of the valves at any point farther forward; lateral extremities, in most examples, somewhat less than rectangular, or sometimes rather acute, more or less compressed and deflected; lateral margins a little contracted posteriorly, and rounding to the front, which forms a regular semicircular curve. Dorsal valve flat in the umbonal region, and rather strongly and evenly convex in the central and interior regions, from which it rounds off abruptly to the front and lateral margins; beak very small, or not distinct from the edge of the narrow or sublinear area, which is inclined nearly directly backward, but not incurved. Interior showing the cardinal process to be small, depressed, divided to its base into two diverging tooth-like parts, a little flattened on their posterior faces, and directed very obliquely forward and outward; socket ridges short and oblique; mesial ridge low, extending but a little distance forward; while the space between it and the socket ridge, on each side, is occupied by a moderately distinct muscular scar.

Ventral valve broadly and rather deeply concave in the central and anterior regions, and sharply convex at the beak, which is very small, abruptly pointed, scarcely projecting beyond the edge of the area, and usually minutely perforated; area moderately high, extending the whole length of the hinge, generally but little sloping laterally, flattened and inclined more or less backward; foramen closed by a prominent, rounded pseudodeltidium that is transversely striated, and rather broadly

sinuous on its inner edge, for the reception of the cardinal process of the other valve. Interior showing hinge teeth to be well developed, trigonal, and striated on their posterior sides; while from their inner bases the dental laminæ extend forward so as nearly to encircle the usual saucer-shape depression for the muscular scars, which is sometimes divided by a small, linear mesial ridge; cardinal margin prominent and sharp within on each side of the hinge teeth; anterior and lateral regions more or less thickened within, and roughened by the crossing of the vascular markings, which are scarcely visible on any part within this zone.

Surface of both valves ornamented by numerous fine, closely crowded, radiating striæ, that are often alternately a little larger and smaller, or on some parts, with several of the smaller ones between each two of the larger—the smaller being always shorter than the larger, or ending at various distances between the free margins and the beaks, without coalescing with those between which they are intercalated. Striæ and furrows minutely crenulated by extremely small, very regular, closely arranged concentric lines, invisible without the aid of a magnifier; a few subimbricating marks of growth are likewise sometimes near the free margins. (Meek.)

Horizon and localities—Lower Silurian, Hudson shales: Louisiana, Cape Girardeau.

Strophodonta? cymbiformis SWALLOW.

Strophodonta cymbiformis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 635.

Strophodonta subcymbiformis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 635.

Strophodonta kemperi Swallow, 1860: Trans. St. Louis Acad. Sci, vol. I, p. 636.

Strophodonta inflexa Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 637.

Strophodonta boonensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 638.

Shell rather large, like *S. demissa* but with a broad, median sinus and fold.

Horizon and localities.—Devonian, Callaway limestone: Dauphin (Callaway county).

Leptæna sericea Sowerby.

Plate xxxix, fig. 9.

Leptæna sericea Sowerby, 1839: Sil. Syst., p xix, figs. 1-2.
Strophomena sericea Conrad, 1840: Geol. New York, Ann. Rep., p. 201.
Leptæna sericea Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 70, pl. 5, figs. 3a-h.

Shell small, transverse, semi-oval, approaching semi-circular, concavo-convex; hinge-line equaling, or more frequently a little longer than the breadth of the valves at any point farther forward; lateral extremities varying from somewhat acutely angular to nearly or quite rectangular, and not properly reflected; anterior and lateral margins forming together nearly a regular semi-circle curve. Dorsal valve concave, its deepest concavity being near the middle; beak not distinct from the cardinal margin; area narrow or nearly linear, and ranging at right angles to the plane of the valves. Interior showing cardinal margin to be minutely crenulated toward the lateral extremities; cardinal process moderately prominent, and trifid, the middle division being most prominent, with a deep pit at its inner base; brachial? process short, appressed, and widely divergent; muscular impressions generally obscurely defined, occupying an obcordate area, and separated from each other by two subparallel, narrow ridges that sometimes coalesce near the base of the cardinal process; each impression usually nearly equally divided by a slender linear, straight ridge; anterior and lateral regions more or less roughened by minute granular radiating striæ.

"Ventral valve moderately convex, being nearly evenly but gently arched along the middle from beak to the front, and thus following so nearly the curve of the other valve as to leave but a very thin visceral cavity within; beak very small, or scarcely if at all distinct from the cardinal margin; area twice or three times as high as that of the other valve, inclined backward, or more or less nearly parallel to the plane of the valves; foramen arched over near the beak by a small false deltidium, closed between this and the hinge margin by the prominent cardinal process of the valve. Interior showing

hinge margin to be obscurely marked with minute pits for the reception of the crenulations of that of the other valve; teeth small; muscular impressions long, narrow, separated behind by a short linear mesial ridge, and diverging and extending forward beyond the middle of the valve, with a moderately distinct dental ridge along the lateral margin of each; anterior and lateral regions granulo-striated. Surface of both valves marked by numerous minute, closely arranged radiating striæ, about every fourth, fifth or sixth one of which is a little larger and more prominent than those between. (Meek.)

Horizon and localities.—Lower Silurian, Hudson shales: Louisiana.

Leptæna mesacosta SHUMARD.

Leptæna mesacosta Shumard, 1856: Geol. Sur. Missouri, Ann. Rep., p. 205, pl. C, fig. 2.

Shell small, about as wide as long, the hinge-line being much shorter than in *L. sericea.*

Horizon and localities.—Lower Silurian, Girardeau limestone: Cape Girardeau.

Syntrilasma hemiplicata (HALL).

Plate xxxix, figs. 8a-d.

Spirifer hemiplicatus Hall, 1852: Stansbury's Expd. Gt. Salt Lake, p. 409, pl. iv, fig. 3a-b.

Syntrilasma hemiplicata Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 323, figs. 37a-b.

Rhynchonella angulata Geinitz, 1866: Carb. und Dyas in Nebraska, p. 37, tab. iii, figs. 1-4. (Not *R. angulata* Linnæus, 1767.)

Syntrilasma hemiplicata Meek, 1872: U. S. Geol. Sur. Nebraska, p. 177, pl. vi, figs. 12a-b.

Shell subglobose, with several large, rounded plications anteriorly; hinge-line about one-third the greatest width of the valves. Ventral valve not as convex as the dorsal; beak not prominent, somewhat incurved; cardinal area small, broad, triangular; foramen about as wide as high. Dorsal valve much more arched than the other; beak much incurved; area narrow. Surface ornamented with small, radiating lines, which are crossed by lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Spirifera perlamellosa? Hall.

Spirifer lamellosus Hall, 1857: Reg. Rep. Univ. New York, p. 57.
Spirifer lamellosus Hall, 1859: Pal. New York, vol. III, p. 291, pl. xxvi, figs. 1-2.
Spirifer lamellosus Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 284, pl. vii, figs. 9a-b.

A small shell with large, rounded, radiating folds, and imbricated lines of growth.

Horizon and localities.—Upper Silurian limestone: Bailey landing (Perry county).

This form is reported by Meek & Worthen from Missouri, but it probably cannot be regarded as strictly identical with the New York species described by Hall.

Spirifera parryana Hall.

Plate xi, figs. 4a-b.

Spirifer euruteines Owen, 1852: U. S. Geol. Sur. Wisconsin, Iowa and Minnesota, p. 586, tab. iii, figs. 2-2a and 6-6a. (Not Owen, 1844.)
Spirifer parryanus Hall, 1858: Geology Iowa, vol. I, p. 509, pl. iv, figs. 8a-b.
Spirifer capax Hall, 1858: Geology Iowa, vol. I, p. 520, pl. vii, figs. 7a-d.
Spirifer fornacula Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 433, pl. xiii, figs. 8a-e. (Not Hall, 1857.)
Spirifera parryana Calvin, 1888: Bul. Lab. Nat. Hist. State Univ. Iowa, vol. I, p. 19.

A rather large, robust form with broad area.

Horizon and localities—Devonian, Hamilton? limestone: Perry county.

Spirifera ligus Owen.

Spirifer ligus Owen, 1852: U. S. Geol. Sur. Wisconsin, Iowa and Minnesota, p. 585, tab. iii, fig. 4.
Spirifer permatus Owen, 1852: U. S. Geol. Sur. Wisconsin, Iowa and Minnesota, p. 585, tab. iii, figs. 3-3a.
Spirifer pennextensus Meek & Worthen, 1868: Geol. Sur. Illinois, vol. II, p. 414, pl. x, figs. 1a-d.
Spirifera atwateriana Miller, 1878: Proc. Dav. Acad. Sci., vol. II, p. 221.

A large, very variable form, with long hinge-line and usually rather broad cardinal area.

Horizon and localities—Devonian, Hamilton? limestone: Perry county.

Spirifera subrotundata HALL.

Spirifer subrotundatus Hall, 1858: Geology Iowa, vol. I, p. 521, pl. vii, figs. 8a-b.

Rather below medium size, gibbous, subglobose; hinge-line shorter than greatest width of shell, cardinal extremities rounded. Surface marked like *S. grimesi.*

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Sedalia.

Spirifera taneyensis SWALLOW.

Spirifer taneyensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 645.

A small, gibbous, submucronate shell with large plications, about ten in number.

Horizon and localities.— Lower Carboniferous, Kinderhook beds: Taney county, according to Swallow.

Spirifera cooperensis SWALLOW.

Spirifer cooperensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 643.

Spirifer cooperensis Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 155, pl. xiv, figs. 5a-b.

A small, Athyris-like form, resembling the common *S. perplexa* from the Coal Measures, but having obscure radiating folds.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Chouteau Springs (Cooper county).

Spirifera marionensis SHUMARD.

Spirifer marionensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 203, pl. C, figs. 8a-b.

Spirifer marionensis Hall, 1858: Geology Iowa, vol. I, p. 511, pl. vi, figs. 1a-c.

Spirifer osagensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 641.

Spirifer missouriensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I. p. 643.

Spirifer vernonensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 644.

Spirifer ozarkensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 644.

Shell quite variable, usually somewhat wider than long, thick; hinge-line varying in length from once to twice the length, and often mucronate. Cardinal area narrow. Surface marked by simple rounded ridges, 20 or 25 on each side of the median fold.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Chouteau Springs (Cooper county), Hannibal, Louisiana, Clarksville (Pike county), and elsewhere.

Spirifera peculiaris Shumard.

Spirifer peculiaris Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 202, pl. C, figs. 7a-b.

A small subglobose form with broad plications.

Horizon and localities.—Lower Carboniferous, Kinderhook limestone: Chouteau Springs (Cooper county).

Spirifera grimesi Hall.

Spirifer grimesi Hall, 1858: Geology Iowa, vol. I. p. 604, pl. xlv, figs. 1-5.

Shell very large, subglobose, usually longer than wide; hinge-line about three-fourths as long as the greatest width. Dorsal valve less convex than ventral, with a low, broad mesial fold, which becomes quite prominent at the anterior border. Ventral valve very convex, especially toward the umbo; mesial sinus broad, shallow; area rather short, moderately high; foramen wide; beak incurved. Surface marked by low, broad radiating ribs, which occupy the median fold and sinus as well as the other parts of the shell. The folds again marked by fine longitudinal lines.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Hannibal, Louisiana, Sedalia; Burlington limestone: Palmyra (Marion county), Hannibal, Louisiana, Sedalia, Springfield, Ste. Genevieve.

This species is one of the most characteristic forms of the Burlington limestone. As remarked by Hall, the shell is seldom found entire and undistorted, though one of the most abundant and widely distributed forms. The valves are easily separated, and being very thin, the specimens are commonly flattened out, thus making the hinge-line appear much longer

than it really is. At first glance it then appears strikingly like *S. logani* Hall, but that form is a much heavier shell, has a hinge-line very much longer, a lower cardinal area, and coarse radiating costæ. While probably closely related to *S. grimesi* genetically, *S. logani* seems to be sufficiently distinct to need a separate specific designation. So far as is known, it has not been found below the Keokuk limestone. *S. grimesi* as it occurs in the Kinderhook is still lighter in weight, has a still shorter hinge-line and finer ornamentation than the typical examples of the Burlington. The species is not so abundant in Upper Burlington as in the Lower division; and may extend into the Keokuk.

Spirifera forbesi Norwood & Pratten.

Plate xl, fig. 8.

Spirifer forbesi Norwood & Pratten, 1854: Jour. Acad. Sci., Phila., vol. III, p. 73.
Spirifer forbesi Hall, 1858: Geology Iowa, vol I, p. 600, pl. xiii, fig 1.

Shell with hinge-line greatly extended, flattened, mesial fold and sinus small; radiating ribs, flattened, rather large.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal, Louisiana, Sedalia, Springfield.

Spirifera imbrex Hall.

Spirifer imbrex Hall, 1858: Geology Iowa, vol. I, p. 601, pl. xiii, fig. 2.

Shell similar to *S. forbesi*, but hinge-line much shorter, mesial fold much broader, and lines of growth imbricated.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal, Louisiana.

Spirifera lineatoides Swallow.

Plate xl, fig. 6.

Spirifer lineatoides Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 645.

Shell large, robust, transversely elliptical. Ventral valve more convex toward the beak; hinge-line short, rather high; beak strongly incurved. Dorsal valve moderately convex, mesial fold broad, low, or scarcely defined. Surface marked by broad punctato-concentric bands.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal.

The specimen figured under this name, though slightly smaller than Swallow's type, is believed to represent this species.

Spirifera logani HALL.

Spirifer logani Hall, 1858: Geology Iowa, vol. I, p. 647, pl. xxi, figs. 1a-b, and 2.

Spirifer lævigatus Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 86.

Shell very large, with close analogies to *S. grimesi*, but having a much longer hinge-line, coarser plications and much thicker test.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Wayland and St. Francisville (Clark county); Keokuk (Iowa).

Spirifera lævigata of Swallow is too poorly described to deserve recognition. Moreover, it seems probable that Swallow had in hand a water-worn valve of *S. logani*, not uncommon at Keokuk and elsewhere.

Spirifera kelloggi SWALLOW.

Spirifer kelloggi Swallow, 1863: Trans. St. Louis Acad. Sci, vol II, p. 86.

A small plicated form closely resembling *S. spinosus* of Norwood & Pratten, but apparently having no spines.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Spirifera keokuk HALL.

Plate xl, fig. 2.

Spirifer keokuk Hall, 1858: Geology Iowa, vol. I, p. 642, pl. xx, figs, 3a-d.

Spirifer littoni Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 646.

Spirifer keokuk var. *shelbyensis* Swallow, 1866: Trans. St. Louis Acad. Sci., vol. II, p. 410.

Shell rather small, robust, transversely elliptical. Plications coarse, rounded; mesial fold and sinus well defined.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Wayland (Clark county); Keokuk (Iowa).

Spirifera rostellata Hall.

Spirifer rostellatus Hall, 1858: Geology Iowa, vol. I, p. 641, pl. xx, figs. 2a–c.

Of the *S. grimesi* type, but very much smaller.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Bonaparte (Iowa).

Spirifera pseudolineata Hall.

Spirifer pseudolineatus Hall, 1858: Geology Iowa, vol. I, p. 645, pl. xx, fig. 4.

Like *S. lineatoides* but broader, smaller, with mesial fold more pronounced, and ornamentation finer.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: St. Francisville (Clark county).

Spirifera leidyi Norwood & Pratten.

Spirifer leidyi Norwood & Pratten, 1855: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 72.

Spirifer leidyi, var. *chesterensis* Swallow, 1866: Trans. St. Louis Acad. Sci., vol. II, p. 409.

Spirifer leidyi, var. *merimacensis* Swallow, 1866: Trans. St. Louis Acad. Sci., vol. II, p. 410.

Shell similar to that of *S. keokuk.*

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county); Saint Louis limestone: Ste. Genevieve.

Spirifera increbescens Hall.

Spirifer increbescens Hall, 1858: Geology Iowa, vol. I, p. 706, pl. xxvii, figs. 6a–i.

Spirifer increbescens, var. *americanus* Swallow, 1866: Trans. St. Louis Acad. Sci., vol. II, p. 410.

Very closely related to *S. keokuk* and may eventually prove identical with that species.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Spirifera setigera HALL.

Spirifer setigerus Hall, 1858: Geology Iowa, vol. I, p. 705, pl. xxvii, figs. 4a–b.

Spirifer translatus Swallow: Trans. St. Louis Acad. Sci., vol. II, p. 85.

Of the *S. lineatus* type, but larger than that species, and with a more clearly defined median fold and sinus.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Spirifera contracta MEEK & WORTHEN.

Spirifer glaber, var. *contractus* Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 298, pl. xxiii, figs. 5a–b.

A large Athyris-like shell, but with the other Spirifer characters.

Horizon and localities—Lower Carboniferous, Kaskaskia limestone: Chester (Illinois).

Spirifera camerata MORTON.

Plate xl, figs. 5a–c.

Spirifer cameratus Morton, 1836: Am. Jour. Sci., vol. xxix, p. 150, pl. ii, fig. 3.

Spirifer triplicatus Hall, 1852: Stansbury's Exped. Gt. Salt Lake, p. 410, pl. ii, fig. 5.

Spirifer fasciger? Owen, 1852: Geol. Sur. Wisconsin, Iowa and Minnesota, pl. v, fig. 4.

Spirifer meusebachanus Roemer, 1852: Kreid. von Texas, p. 88, tab. xi, fig. 7.

Spirifer cameratus Hall, 1856: Pacific R. R. Sur., vol. III, p. 102, pl. ii, figs. 9, 12, 13.

Spirifer cameratus Hall, 1858: Geology Iowa, vol. I, p. 709, pl. xxvii, figs. 2a–b.

Spirifer cameratus, var. *kansasensis* Swallow, 1866: Trans. St. Louis Acad. Sci., vol II, p. 409.

Spirifer cameratus, var. *percrassus* Swallow, 1866: Trans. St. Louis Acad. Sci., vol. II, p. 409.

Spirifer cameratus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 183, pl. vi, fig. 12, pl. viii, fig. 15.

Spirifer cameratus Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 573.

Spirifer cameratus White, 1875: U. S. Geog. Sur. w. 100 Merid., p. 132, pl. x, figs. 1a–d.

Spirifer cameratus White, 1881: Geol. Sur. Indiana, Ann. Rep. 1880, p. 149, pl. viii, fig. 3.

Spirifer cameratus White, 1884: Geol. Sur. Indiana, Ann. Rep. for 1883, pt. ii, p. 133, pl. xxxv, figs. 3–5.

Spirifera camerata Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 230.

Shell of medium size, rather ventricose, semicircular to subtrigonal in outline; hinge-line equaling or longer than greatest breadth of the valves. Ventral valve the more arched; beak incurved, prominent; cardinal area well defined, moderately high, somewhat curved; foramen equilaterally triangular; median sinus well marked. Dorsal valve with an inconspicuous beak; mesial fold sharply rounded. Surface marked by prominent radiating ribs, which usually group themselves into fascicles of three to five or more. Lines of growth seldom well defined.

Horizon and localities.—Upper Carboniferous, Coal Measures: Clinton (Henry county), Kansas City, Lexington.

Spirifera rockymontana MARCOU.

Spirifer rockymontanus Marcou, 1858: Geol. North America, p. 50.
Spirifer opimus Hall, 1858: Geology Iowa, vol. I, p. 711, pl. xxviii, figs. 1a-b.
Spririfer subventricosus McChesney, 1860: Desc. New Palæ. Foss., p. 44.
Spirifer boonensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 648.
Spirifera rockymontana Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 231.

Closely related to *S. keokuk* and probably the genetic successor of that species.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Spirifera perplexa MCCHESNEY.

Spirifer lineatus (American authors, not Martin, 1809).
Spirifer perplexus McChesney, 1860: Desc. New Palæ. Foss., p. 43.
Spirifer lineatus Swallow, 1866: Trans. St. Louis Acad. Sci., vol. II, p. 409.
Spirifer lineatus, var. *striato-lineatus* Swallow, 1866: Trans. St. Louis Acad. Sci., vol. II, p. 408.

Shell much like an Athyris in general appearances, but with distinct cardinal area. Surface nearly smooth, but having faint radiating lines, and crenulated lines of growth, from which spring minute spines, apparently.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Spirifera planoconvexus Shumard.

Spirifer planoconvexus Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 202.
Ambocœlia gemmula McChesney, 1860: Desc. New Pal. Foss., p. 41.
Spirifer planoconvexus Meek & Hayden, 1864: Palæ. Upper Missouri, p. 20.
Spirifer planoconvexus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 42, tab. iii, figs. 10-18.
Martinia planoconvexa McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 34, pl. i, fig. 1.
Spirifer planoconvexus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 186, pl. iv, figs. 4a-b, and pl. viii, figs. 2a-b.

Shell quite small, plano-convex, subcircular in outline; hinge-line somewhat shorter than greatest width of the valves; surface glabrate, with indistinct lines of growth, but under a magnifier often showing minute spines. Ventral valve strongly arched, often with faint traces of a slight median depression; beak prominent; area of moderate height; foramen narrow. Dorsal valve nearly plane; beak not well-defined; area narrow.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Spiriferina clarksvillensis Winchell.

Spiriferina clarksvillensis Winchell, 1865: Proc. Acad. Nat. Sci., Phila., p. 119.

A small form closely resembling *S. kentuckensis*, but with longer hinge-line.

Horizon and localities.—Lower Carboniferous, Louisiana (Kinderhook) limestone: Clarksville (Pike county).

Spiriferina spinosa (Norwood & Pratten).

pirifer spinosa Norwood & Pratten, 1855: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 71, pl. ix, figs. 1a-d.
pirifer spinosa Hall, 1858: Geology Iowa, vol I, p. 706, pl. xxvii, figs. 5a-c.
Spiriferina spinosa Miller, 1877: Cat. Am. Pal. Foss., p. 133.

Larger than *S. kentuckensis*, more robust, with shorter hinge line, higher cardinal area, and larger plications.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Spiriferina kentuckensis (SHUMARD).

Spirifer octoplicatus Hall, 1852: Stansbury's Expd. Gt. Salt Lake, p. 409, pl. xi, figs. 4a-b (not Sowerby).
Spirifer kentuckensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 203.
Spirifer kentuckensis Hall, 1856: Pac. R. R. Reports, vol. III, p. 103, pl. ii, figs. 10, 11.
Spirifer laminosus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 45, tab. iii, figs. 19a-d. (Not McCoy.)
Spirifer kentuckensis, var. *propatulus* Swallow, 1866: Trans. St. Louis Acad. Sci., vol. II, p. 409.
Spiriferina kentuckensis Meek, 1872: U. S. Geol. Sur. Nebraska, p. 185, pl. vi, figs. 3a-d, and pl. vii, figs. 11a-b.
Spiriferina kentuckensis White, 1875: Expl. and Sur. w. 100 Merid, vol. IV, p. 138, pl. x, figs. 4a.-c.
Spiriferina kentuckensis Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 231.

Shell small, quite variable, wider than long, with a narrow and deep mesial sinus and fold, on each side of which are from four to ten simple, sharply angular ribs. Ventral valve slightly more arched than the other; beak prominent, curved; area well defined; foramen slightly higher than wide. Dorsal valve with inconspicuous beak and narrow hinge area. Surface of valves marked by numerous crowded, strongly imbricated lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City, Lexington.

Syringothyris occidentalis (SWALLOW).

Cyrtia occidentalis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 648.
Cyrtina occidentalis Miller, 1877: Cat. Am. Pal. Foss., p. 110.

Similar to *S. carteri*, but much smaller, and with the cardinal extremities more rounded.

Horizon and localities.—Devonian, Callaway limestone: Callaway county.

Syringothyris extenuata (HALL).

Spirifer extenuatus Hall, 1858: Geology Iowa, vol. I, p. 520, pl. vii, fig. 6.
Syringothyris halli Winchell, 1863: Proc. Acad. Nat. Sci., Phila., p. 8.
Syringothyris extenuata Schuchert, 1890: Ninth Ann. Rep. State Geologist New York, p. 33.

Closely related to *S. carteri*, but smaller, with cardinal extremities more attenuated.

Horizon and localities.—Lower Carboniferous, Kinderhook limestone: Clarksville (Pike county).

Syringothyris carteri (Hall).

Plate xl, fig. 10.

Spirifer carteri Hall, 1857: Tenth Rep. New York State Cab. Nat. Hist., p. 170.

Spirifer (*Cyrtia*) *hannibalensis* Swallow, 1860: Trans. St. Louis Acad. Sci., vol. 1, p. 647.

Syringothyris typa Winchell, 1863: Proc. Acad. Nat. Sci., Phila., p. 7.

Syringothyris typa Winchell, 1870: Proc. Am. Philos. Soc., vol. XII, p. 252.

Syringothyris cuspidatus Herrick, 1888: Bul. Dennison Univ., vol. III, p. 41, pl. i, fig. 7.

Syringothyris carteri Schuchert, 1890: Ninth Ann. Rep. State Geologist New York, p. 30.

Shell attaining a rather large size, very thin, nearly semicircular, as seen in a direct view from above or below, and rhombic-subquadrangular in a front or posterior view, with length generally a little more than half the breadth, and the breadth usually about twice the height of the area; hinge-line about equaling the greatest breadth; front and lateral margins forming together a more or less nearly semi-circular curve, or with the central part of the former sometimes a little straightened, or even very faintly sinuous in outline, and the latter meeting the hinge at rather less than right angles behind. Dorsal valve moderately convex in the central region, thence sloping laterally and rounding more abruptly to the beak and anterior lateral margins than to the middle of the front; mesial fold depressed, smoothly rounded, equaling about two-thirds the breadth of the valves at the front, and sometimes showing on internal casts a faint linear mesial impression; beak small, and with the very narrow area incurved.

Ventral valve much elevated at the beak, thence sloping laterally, with slightly convex outlines, at an angle of 100° to 125°, and more abruptly to the front and anterior lateral margins; mesial sinus smoothly rounded within, rather shallow or moderately deep anteriorly, where it terminates in a short, rounded projection fitting into a corresponding sinus in the margin of the other valve; beak elevated, obtusely angular and

straight, or a little arched backward; area high, transversely and vertically striated, ranging more or less nearly at right angles to the plane of the valves, and flattened or somewhat arched backward, with its lateral margins moderately well-defined; foramen large, or about two-sevenths as wide at the hinge-line as the length of the latter, and three-fifths as wide as high, showing its deep-seated transverse septum and tube to be well developed above within.

Surface of both valves ornamented on each side of the non-costate mesial fold and sinus by about eighteen to twenty simple, depressed, rounded, radiating costæ, some five or six of which on each side of the lateral extremities of both valves are usually nearly or quite obsolete. Crossing all of these on well-preserved specimens, numerous fine concentric striæ and some stronger marks of growth may be seen, and over the whole a minute pitting may be observed, so crowded and arranged as to present a delicate appearance, as seen by the aid of a magnifier. (Meek.)

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Clarksville (Pike county); Louisiana, Hannibal; Burlington limestone: Springfield.

Syringothyris plena (Hall).

Plate xl, fig. 8.

Spirifer plenus Hall, 1858: Geology Iowa, vol. I, p. 603, pl. xiii, figs. 4a-e.
Syringothyris? plena Schuchert, 1890: Ninth Ann. Rep. State Geologist New York, p. 37.

A large heavy shell, distinguished from the associated forms by its large curved area.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal.

Syringothyris texta (Hall).

Spirifer textus Hall, 1857: 10th Rep. Reg. State Cab. Nat. Hist., p. 169.
Spirifer subcuspidatus Hall, 1858: Geology Iowa, vol. I, p. 646, pl. xx, fig. 5.
Spirifer propinquus Hall, 1858: Geology Iowa, vol. I, p. 647.
Spirifer subcuspidatus Hall, 1867: Pal. New York, vol. IV, p. 249.
Spirifer propinquus Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 530, pl. xix, fig. 8.

Spirifer cuspidatiformis Miller, 1889: N. A. Geol. and Pal., p. 372.
Syringothyris texta Schuchert, 1890: 9th Ann. Rep. State Geologist New York, p. 34.

Like *S. carteri*, but much heavier, larger and robust.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Cyrtina dalmani? (Hall).

Cyrtia dalmani Hall, 1857: 10th Rep. New York State Cab. Nat. Hist., p. 64.
Cyrtia dalmani Hall, 1859: Pal. New York, vol. III, p. 206, pl. xxiv, figs. a-y.
Cyrtina dalmani Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 383, pl. vii, figs. 3a-b.

A small form closely related to *C. acutirostris.*

Horizon and localities. — Devonian, Hamilton ? limestone: Bailey landing (Perry county).

Cyrtina acutirostris (Shumard)

Plate xxxix, figs. 10a-b.

Cyrtia acutirostris Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 204, pl. C, figs. 3a-c.

Shell small; area very high, nearly an equilateral triangle; greatest width at the cardinal margin. Beak of dorsal valve very slightly incurved in most specimens, sometimes straight; deltoid aperture narrow, becoming abruptly dilated near the base; lateral edges slightly elevated; the elevation most prominent at the dilated portion; mesial sinus commencing at the tip of the beak, rather deeply impressed, and destitute of ribs. Ventral valve semi-elliptical, flattened, convex; mesial ridge elevated above the general convexity of the valve, and well defined by a wide concave space on either side. Some specimens exhibit a faint longitudinal sinus running the whole length of the mesial fold. Valves with four or five simple, rounded ribs on each side of the mesial fold and sinus, crossed by the undulating subimbricating lines of growth. (Shumard.)

Horizon and localities.— Lower Carboniferous, Louisiana (Kinderhook) limestone: Louisiana, Hannibal.

Cyrtina umbonata (Hall).

Cyrtia umbonata Hall, 1858: Geology Iowa, vol. I, p. 512, pl. v, figs. 2a-c.
Cyrtia missouriensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 647.
Cyrtina umbonata Miller, 1877: Cat. Am. Pal. Foss., p. 110.

Similar to *C. acutirostris*, but more robust, with shorter hinge-line and lower area.

Horizon and localities.—Devonian, Callaway limestone: Callaway county (Swallow).

Ambocœlia minuta White.

Ambocœlia minuta White, 1862: Proc. Boston Soc. Nat. Hist., vol. IX, p. 26.

Shell very small, subcircular in outline, and marked by well-defined lines of growth.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Hannibal.

Athyris vittata Hall.

Plate xii, figs. 1a-b.

Athyris vittata Hall, 1860: 13th Rep. N. Y. State Mus. Nat. Hist., p 89.
Spirigera minima Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 649.
Spirigera fultonensis Swallow, 1860: Trans. St. Louis Acad Sci., vol. I, p. 650.
Athyris vittata Hall, 1867: Pal. New York, vol. IV, p. 289, pl. xlvi, figs. 1-4.

Shell very similar to *A. argentea*, but adult specimens are much smaller, less ventricose, and the concentric laminations much more pronounced.

Horizon and localities—Devonian, Callaway limestone: Dauphin (Callaway county).

Careful comparisons of a large series of good specimens from Swallow's type locality seem to show conclusively that *Spirigera minima* is merely the young of *S. fultonensis*. And the latter appears to be, without the slightest shadow of doubt, specifically identical with the common forms so widely distributed throughout the Mississippi basin in the Devonian rocks, and so generally known under the name *Athyris vittata* of Hall.

Athyris hannibalensis (Swallow).

Plate xli, fig. 9.

Spirigera hannibalensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 649.

A rather large, lenticular form, with distant, concentric, imbricated lines of growth.

Horizon and localities. — Lower Carboniferous, Louisiana (Kinderhook) limestone: Hannibal, Louisiana, Sulphur Springs (Saint Louis county).

Athyris proutii (Swallow).

Spirigera proutii Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 649.

Resembling *A. vittata*, but with mesial fold more pronounced.

Horizon and localities.—Lower Carboniferous, Louisiana, (Kinderhook) limestone: Hannibal, Louisiana, Clarksville (Pike county), Sulphur Springs (Saint Louis county).

Athyris incrassatus Hall.

Plate xli, fig. 10.

Athyris incrassatus Hall, 1858: Geology Iowa, vol. I, p. 600, pl. xii, fig. 6.

Shell very large, heavy, flattened, with occasional imbricated lines of growth; surface otherwise smooth.

Horizon and localities —Lower Carboniferous, Burlington limestone: Hannibal.

Athyris formosa (Swallow).

Spirigera formosa Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 91.

Spirigera euzona Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 91.

A small form resembling closely *A. trinuclea.*

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Boonville (Cooper county).

Athyris trinuclea (Hall).

Terebratula trinuclea, Hall, 1858: Geology Iowa, vol. I, p. 659, pl. xxiii, figs. 4a–c.
Spirigera reflexa Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 88.

A very variable shell like *A. argentea*, the trilobate character being usually more pronounced than in most other forms of the group.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett station (St. Louis county).

Athyris subquadrata Hall.

Athyris subquadrata Hall, 1858: Geology Iowa, vol. I, p. 703, pl. xxvii, figs. 2a-d.
Spirigera clintonensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 89.

A rather large, trilobate form, much like the smaller *A. trinuclea.*

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Athyris sublamellosa Hall.

Athyris sublamellosa Hall, 1858: Geology Iowa, vol. I, p. 702, pl. xxvii, figs. 1a-c.
Spirigera americana Swallow, 1863: Trans. St. Louis Acad. Sci , vol. II, p. 89.

A large shell with prominently imbricated concentric lines of growth.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Athyris argentea (Shepard).

Plate xxxix, figs. 11a–d.

Terebratula argentea Shepard, 1838: Am. Jour. Sci., vol. XXXIV, p. 152.
Terebratula subtilita Hall, 1852: Stansbury's Exped. Gt. Salt Lake, p. 409, pl. iv, figs. 1a–b, and 2a-b.
Terebratula subtilita Schiel, 1855: Pacific R. R. Sur., vol. II, p. 108, pl. i, fig. 2.
Terebratula subtilita Hall, 1856: Pacific R. R. Sur., vol. III, p. 101, pl. ii, fig. 4.
Terebratula subtilita Davidson, 1857: Monog. Brit. Carb. Brachiopods, p. 18, pl. i, figs. 21, 22.

Terebratula subtilita Marcou, 1858: Geol. N. A., p. 52, pl. vi, fig. 9.

Spirigera subtilita Meek & Hayden, 1859: Proc. Acad. Nat. Sci., Phila., p. 20.

Athyris differentis McChesney, 1859: Desc. New Sp. Foss. Pal. Rocks Western States.

Spirigera charitonensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. 1, p. 651.

Spirigera hawni Swallow, 1860: Trans. St. Louis Acad. Sci., vol. 1, p. 652.

Athyris subtilita Newberry, 1861: Ives' Exped. Colorado River, Paleontology, p. 126

Spirigera singletoni Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 87.

Spirigera capnt-serpentis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 90.

Athyris subtilita Geinitz, 1866: Carb. und Dyas in Nebraska, p. 40, tab. iii, figs. 7-9.

Athyris subtilita Meek, 1872: U. S. Geol. Sur. Nebraska, p. 180, pl. i, fig. 12, pl. v, fig. 8, pl. viii, fig. 4.

Athyris subtilita Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 570, pl. xxv, fig. 14.

Spirigera subtilita White, 1885: U. S. Geol. Sur. w. 100 Merid., vol IV, p. 141, pl. x, figs. 6a-c.

Athyris subtilita Meek, 1877: U. S. Geol. Exp. 40 Par., vol. IV, p. 88, pl. viii, figs. 6, 6a.

Athyris subtilita White, 1884: Geol. Sur. Indiana, 13th Ann. Rept, p. 136, pl. xxxv, figs. 6-9.

Athyris subtilita Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 231.

Shell rather small, sublenticular to subglobose. Ventral valve regularly arched and usually slightly more convex than opposite one; beak quite prominent, rounded, incurved and truncated by the circular foramen; median sinus obsolete in young specimens, but often quite prominent in older individuals. Dorsal valve convex, with a well-marked mesial fold in adult specimens; beak not prominent. Surface of valves glabrate, with occasional lines of growth, which, in large specimens, are more or less imbricated.

Horizon and localities.—Upper Carboniferous, Coal Measures: Kansas City, Lexington, Clinton (Henry county).

The name *Terebratula argentea* was proposed by Shepard more than half a century ago for a shell from the Coal Measures of LaSalle, Illinois, in all respects apparently identical with the form described by Hall fourteen years later. Although Shepard's diagnosis is quite brief, and his two figures rather crude,

there is but little doubt that he had one of the commonest fossils of the well-known locality just mentioned. Even if it were desirable to overlook the name applied to the LaSalle specimens, the more familiar specific title of Hall, *A. subtilita*, could not be retained, inasmuch as the same form had previously been named and figured on at least two different occasions.

Swallow has described a number of shells under Spirigera (Athyris) from the Coal Measures of Missouri and Kansas. With most of these it is impossible to tell much from the diagnoses given; while with others it is manifest that the writer had in hand various individuals of the very variable *Athyris argentea*, so common everywhere in the Coal Measures of the Mississippi basin.

Nucleospira pisiformis Hall.

Plate lxi, fig. 5.

Nucleospira pisiformis Hall, 1859: Pal. New York, vol. III, Explan. pl. xxviii B.

Nucleospira pisiformis Hall, 1882: Geol. Sur. Indiana, 11th Ann. Rept, p. 301, pl. xxv, figs. 22-26.

Shell subglobose, valves nearly equal. Ventral valve slightly the more convex, especially toward the beak, which is somewhat elevated; area small, narrow. Surface nearly smooth, but showing lines of growth, and the bases of hair-like spines.

Horizon and localities.—Upper Silurian, Niagara? limestone: Cyrene (Pike county).

Retzia? osagensis Swallow.

Retzia osagensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 653.

Like *R. vera*, but much larger and with much finer costæ.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Cooper county (Swallow).

Retzia verneuiliana Hall.

Retzia verneuiliana Hall, 1856: Trans. Albany Inst, vol IV, p. 19.
Retzia verneuiliana Hall, 1858: Geology Iowa, vol. I, p. 657, pl. xxiii, figs. 4a-d.

Like *R. mormoni*, but with much finer and more numerous costæ.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis.

Retzia vera Hall.

Retzia vera Hall, 1858: Geology Iowa, vol. I, p. 704, pl. xxvii, fig. 3a.
Retzia vera, var. *costata*, Hall, 1858: Geology Iowa, vol. I, p. 704, pl. xxvii, figs. 3b-c.

Shell like *R. mormoni*, but very much larger, and with more numerous and finer radiating ribs.

Horizon and localities—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Retzia mormoni (Marcou).

Plate xii, figs. 2a-c.

Terebratula mormoni Marcou, 1858: Geol. N. A., p. 51, pl. vi, fig. 11.
Retzia punctilifera Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 220.
Retzia mormoni Meek & Hayden, 1859: Proc. Acad. Nat. Sci., Phila., p. 27.
Retzia subglobosa McChesney, 1860: Desc. Pal. Foss., p. 45.
Retzia mormoni Geinitz, 1866: Carb. und Dyas in Nebraska, p. 39, tab. iii, fig. 6.
Retzia punctilifera McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 32, pl. i, fig. 1.
Retzia punctilifera Meek, 1872: U. S. Geol. Sur. Nebraska, p. 181, pl. i, fig. 13; and pl. v, fig. 7.
Retzia mormoni White, 1875: U. S. Geog. Sur. w. 100 Merid., vol. IV, p. 141, pl. x, figs. 7a-c.
Retzia mormoni White, 1884: Geol. Sur. Indiana, Ann. Rep. 1883, pt. ii, p. 136, pl. xxxv, figs. 10-12.
Retzia mormoni Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 231.

Shell small, subovoid, with 12 to 16 simple, radiating costæ; hinge-line short, often slightly extended into small ears. Ventral valve the more convex; beak rather prominent, rounded, somewhat curved; foramen rather large, circular; cardinal area well defined, triangular. Dorsal valve moderately

arched; beak incurved and extended but slightly beyond the hinge margin. Surface, aside from the radiating ribs, nearly smooth, marked only by a few lines of growth; under a magnifier the shell is beautifully punctate.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City, Lexington.

Considerable difference of opinion has long existed as to what name should actually be applied to the form under consideration. Two names are perhaps more prominent than any of the others, as these were both published the same year. They are the titles proposed by Shumard and by Marcou. Bearing upon this question, White seems to have found the most conclusive evidence of the priority of Marcou's term by a few months. He says: "*Orthis pecosi*, *Retzia mormoni*, *Rhynchonella uta*, *R. rockymontana* and *Spirifera rockymontana* were published in his Geology of North America. I have obtained satisfactory evidence that the work was published as early as March 1, 1858." Volume XV of the Bulletin de la Societe Geologique de France contains a statement that a copy of the book was sent to that society on April 20, 1858. In the same year Shumard and Swallow published a paper containing descriptions of the three first-named species, under other names, in the Transactions of the St. Louis Academy of Sciences, but that publication was not made until about the first of June. In December of the same year, Hall published in the Geological Report of Iowa, *Spirifer rockymontana* as *S. opimus;* and in 1860 McChesney published *R. rockymontana* as *R. etoniæformis.* It thus is clear that Marcou is entitled to priority of all five of the names above given.

Trematospira imbricata ? (Hall).

Leptocœlia imbricata Hall, 1857: Ann. Rept. N. Y. State. Mus. Nat. Hist., p 108.

Leptocœlia imbricata Hall, 1859: Pal. New York, vol. III, p. 246, pl. xxxviii, figs. 8-13.

Trematospira imbricata Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 381, pl. vii, figs. 2a-e.

Shell small, rhombic-suborbicular, plano-convex, or concavo-convex; length sometimes a little greater, and in other

examples somewhat less, than the breadth; cardinal margins sloping at various angles from the beaks; lateral margins more or less rounded, or obtusely subangular; front rather irregularly rounded. Dorsal valve nearly flat on each side, and more or less concave in the middle; beak not incurved. Ventral valve convex along the middle, and sloping to the sides; beak incurved a little beyond the hinge. Surface ornamented by about seven to ten rounded plications on each valve, two of which, on the middle of the ventral valve, are larger and more prominent than the others, while the middle one on the other dies out before reaching the beak. Crossing the whole are distinct, regularly arranged, imbricating lamellæ of growth.

Horizon and localities—Upper Silurian limestone: Bailey landing (Perry county).

Atrypa occidentalis Hall.

Atrypa aspera, of American authors.
Atrypa aspera, var. *occidentalis* Hall, 1858: Geology Iowa, vol. I, p. 515, pl. vi, figs. 3a-d.

Shell of medium size, longitudinally subovoid, inequivalve. Ventral valve flattened, somewhat convex in the umbonal region; beak small, closely incurved; foramen very minute. Dorsal valve very convex, often hemispherical; beak closely incurved. Surface marked by large, rounded folds, crossed at rather regular intervals by elevated, curved lamellæ, which are often produced into short, tubular spines.

Horizon and localities.—Devonian limestone: Winfield (Lincoln county).

Atrypa reticularis (Linnæus).

Plate xii, figs. 1a-b

Anomia reticularis Linnæus, 1767: Syst. Nat., vol. I, p. 1152.
Atrypa reticularis Dalman, 1827: Vet. Akad. Handl., p. iv, fig. 2.
Atrypa reticularis Hall, 1858: Geology Iowa, vol. I, p. 515, pl. vi, figs. 4a-c and 5a-c.

Differs from *A. occidentalis* chiefly in the larger size, much finer radiating costæ, and less inbricated character of the concentric lines of growth.

Horizon and localities—Devonian, Callaway limestone: Fulton (Callaway county).

Zygospira modesta (SAY).

Atrypa modesta Say, 1847: Pal. New York, vol. I, p. 141, pl. xxxiii, fig. 15.

Zygospira modesta Hall, 1862: 15th Rep. Reg. New York State Cab. Nat. Hist., p. 154.

Zygospira modesta Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 125, pl. xi, figs. 4a-d.

Shell small, rather depressed, nearly plano-convex, suborbicular, or, sometimes, a little wider than long; posterior lateral margins often slightly straightened and converging to the beaks at an obtuse angle; lateral margins more or less rounded; front rounded, or, sometimes, a little straightened, or very slightly sinuous at the middle. Dorsal valve with a rather shallow, undefined mesial sinus of moderate breadth at the front, but becoming rapidly narrower, and less impressed posteriorly, so as often to die out before reaching the umbo; surface on each side of the sinus gently convex centrally, and sloping to the lateral margins; beak but slightly prominent and incurved. Ventral valve, with a low mesial ridge, corresponding to the sinus of the other valve, excepting that it is generally most prominent near the middle, and somewhat depressed anteriorly; while on each side of the ridge the slopes are distinctly compressed; beak small, abruptly pointed, projecting beyond that of the other valve, and rather distinctly arched; but not so closely incurved as to conceal the small fissure, which seems to be closed below by a deltidium, that leaves a minute aperture above, just under, or extending to, the apex; margin on each side of beak carinated, so as to give the appearance of a kind of false cardinal area. Surface of each valve ornamented by about 16 to 18 small, simple, radiating plications, of which about three to five near the front of the dorsal valve occupy the mesial sinus, the middle one being usually a little the largest; while on the ventral valve about four of the largest occupy the mesial prominence—the furrow between the middle two being generally a little larger and deeper than the others; marks of growth undefined, or extremely minute and obscure. (Meek.)

Horizon and localities.—Lower Silurian, Trenton limestone: Saint Louis county (Hambach).

Zygospira subconcava Meek & Worthen.

Zygospira subconcava Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 380, pl. vii, figs. 1a-d.

A somewhat smaller and more compressed species than *Z. modesta*, and having finer radiating lines.

Horizon and localities.—Upper Silurian limestone: Bailey landing (Perry county).

Camerella calcifera? Billings.

Camerella calcifera Billings, 1861: Canadian Nat. and Geol., vol. VI, p. 318.

Horizon and loclities.—Silurian? Magnesian limestone: Carter county.

Rhynchonella capax (Conrad).

Plate xii, figs. 12a-b.

Atrypa capax Conrad, 1842: Jour. Acad. Nat. Sci., Phila., vol. VIII, p. 264, pl. xiv, fig. 21.
Atrypa increbescens Hall, 1847: Pal. New York, vol. I, p. 146, pl. xxxiii, figs. 14a-y.
Rhynchonella capax Billings, 1862: Pal. Foss. Canada, vol. I, p. 142.
Rhynchonella capax Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 123, pl. xi, figs. 6a-f.

Shell attaining about a medium size, varying with age from compressed sub-trigonal to sub-globose, old examples being often more convex than their diameter in any other direction; posterior lateral margins somewhat straightened and converging to the beaks at about a right angle in young shells, but becoming more rounded in the adult; lateral margins rounding to the front, which is more or less distinctly sinuous, or nearly straight in the middle.

Dorsal valve generally a little more convex than the other, most prominent in the middle, and rounding abruptly, or sloping more gently from the central region in all directions; the more elevated part forming anteriorly a depressed mesial ridge that is nearly flat, and occupied by four plications on top, and rarely continues two-thirds of the way to the strongly incurved

beak; while on young or compressed individuals it is faintly marked, even anteriorly; lateral slopes each occupied by four to seven or eight simple angular plications.

Ventral valve with its beak abruptly pointed and very strongly incurved upon that of the other valve in adult shells, but less distinctly curved, and showing a small opening under its apex in young examples; mesial sinus deep and well defined in gibbous specimens, and less so in the young or more compressed forms, never quite reaching the point of the beak, and always having three simple, rather angular plications in the bottom that extend like the others to the apex of the beak in well-preserved specimens; lateral slopes each occupied by from five to seven simple plications. Entire surface of both valves marked by numerous very regular, strongly zig-zag, prominent, sublaminar marks of growth that become nearly or quite obsolete, sometimes, on old examples. Length of a medium-sized, moderately gibbous individual, 0.75 inch; breadth, 0.81 inch; convexity, 0.66 inch. (Meek.)

Horizon and localities.—Lower Silurian, Hudson shales: Louisiana, Cape Girardeau.

Rhynchonella dentata (Hall).

Plate xii, fig. 3.

Atrypa dentata Hall, 1847: Pal. New York, vol. I, p.148, pl. xxxiii, figs. 14a-c.

Rhynchonella dentata Hall, 1859: State Cab. N. Y., 12th Ann. Rep, p. 65.

Smaller and more slender than *R. capax*.

Horizon and localities.—Silurian, Hudson shales: Cape Girardeau.

Rhynchonella missouriensis Shumard.

Rhynchonella missouriensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 204, pl. C, figs. 5a–c.

Rhynchonella missouriensis Meek & Worthen, 1868: Geol. Sur. Illinois, vol. II, p. 153, pl. xiv, figs. 4a–b.

Shell gibbous, subtriangular, beaks sharp; greatest width usually near the front, but very variable in different ages of the shell. Vertical valve much more elevated than the dorsal

valve; degree of elevation varying according to the age of the shell; beak incurved, pointed; mesial ridge obscure, with from two to three obscure rounded folds, commencing a short distance in advance of the beak and becoming more prominent toward the front, where the valve is emarginate, and presents two or three deep indentations. Dorsal valve slightly convex near the beak, nearly plain anteriorly; sinus broad and shallow in young examples, becoming deeper in the more advanced ages of the shell; it has two or three wide obscure plaits, sometimes reaching the beak. Tongue of sinus quadrangular, bent upward at right angles to the plane of the valve, and in most specimens equal in length to one-third the length of the shell. The cardinal line in sinuous. The surface of the valves is covered with very fine concentric, imbricating waved lines of growth. (Shumard).

Horizon and localities.—Lower Carboniferous, Chouteau (Upper Kinderhook) limestone: Vandever Falls (Cooper county), Providence (Boone county).

Rhynchonella cooperensis SHUMARD.

Rhynchonella cooperensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 204, pl. C, figs. 4a-c.

A form like the immature *R. capax*, but much broader, and larger and with more rounding, radiating costæ.

Horizon and localities.—Lower Carboniferous, Chouteau (Upper Kinderhook) limestone: Providence (Boone county).

Rhynchonella boonensis SHUMARD.

Rhynchonella boonensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 205, pl. C, figs. 6a-b.

Shell sub-triangular, length and breadth about equal; greatest width at the cardinal border, and diminishing rapidly to the front, where it terminates in an obtuse angle; cardinal border sinuous, terminating exteriorly in small salient ears; dorsal valve longitudinally convex, concave from side to side, furnished with two folds, which are very obtuse at the beak, but become rather prominently and broadly angular as they approach the front; sinus indistinct near the beak, large

and moderately deep in front; tongue of sinus triangular; beak rather obtuse, and rather strongly incurved: hinge-line sinuous, and situated some distance within the cardinal border: ventral valve shorter than dorsal valve, convex on the middle, sides nearly perpendicular; mesial fold indistinct near the beak, becoming broad and somewhat prominent in front. (Shumard.)

Horizon and localities.—Lower Carboniferous, Burlington limestone: Columbia (Boone county).

Rhynchonella ringeus Swallow.

Rhynchonella ringeus Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 653.

Shell very large, heavy, triangular. Surface marked by 12 to 14 radiating ridges.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Fulton (Callaway county), Hannibal (Marion county).

Rhynchonella subtrigona Meek & Worthen.

Rhynchonella subtrigona Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 451.

Rhynchonella parvini McChesney, 1861: Desc. New Pal. Foss, p. 83.

Camarophora subtrigona Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 251, pl. xviii, figs. 8a–c.

A large, robust form like *R. cooperensis.*

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Wayland (Clark county).

Rhynchonella subcuncata Hall.

Rhynchonella subcuneata Hall, 1856: Trans. Albany Institute, vol. IV, p. 11.

Rhynchonella subcuneata Hall, 1858: Geology Iowa, vol. I, p. 658, pl. xxiii. figs. 3a-c.

Rhynchonella arctirostrata Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 48.

A rather small, flattened, cuneate shell, with large plications and an obscure mesial sinus.

Horizon and localities.— Lower Carboniferous, Keokuk limestone: Boonville (Cooper county).

Rhynchonella mutata Hall.

Rhynchonella mutata Hall, 1856: Trans. Albany Institute, vol. IV, p. 10.
Rhynchonella mutata Hall, 1858: Geology Iowa, vol. I, p. 658, pl. xxiii, figs. 2a-b.

A small form like *R. subcuneata*, but smaller and less cuneate.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville.

Rhynchonella ottumwa White.

Rhynchonella ottumwa White, 1883: 12th Ann. Rep. U. S. Geol. and Geog. Sur. Terr., p. 165, pl. xli, figs. 5a-c.

Similar to *R. uta*, but with mesial sinus much less pronounced.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: near St. Francisville (Clark county).

Rhynchonella uta (Marcou).

Plate xli, fig. 7.

Terebratula uta Marcou, 1858: Geol. N. A., p. 51, pl. vi, figs. 21a-c.
Rhynchonella (*Camarophoria*) *osagensis* Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 219.
Camarophoria swallowiana Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 394, pl. xi, figs. 1a-e.
Camarophoria globulina Geinitz, 1866: Carb. und Dyas in Nebraska, p. 38, tab. iii, fig. 5 (Not *C. globulina* Phillips, 1834.)
Rhynchonella osagensis Meek, 1872: U. S. Geol. Sur. Nebraska, p. 179, pl. i, figs. 9a-b; and pl. vi, figs. 2a-b.
Rhynchonella osagensis Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 571, pl. xxvii, fig. 22.
Rhynchonella uta White, 1875: U. S. Geog. Sur. w. 100 Merid, vol. IV, p. 128, pl. ix, figs. 2a-c.

Shell small, subtrigonal in outline, slightly wider than long, more or less ventricose. Ventral valve not as convex as the other one; medial sinus short but well defined; beak pointed, not very prominent; foramen small. The median sinus is occupied by two to three sharply angular plications; and each of the lateral lobes by about three similar short ridges. Dorsal valve much more arched than the ventral; median fold rather low, not defined behind the middle of the shell, marked by two

to four plications; three or four elevations also occupy the space on each side of the medial fold; beak curved. Surface of shell smooth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City, Lexington.

Meristella lævis (VAUNEXEM).

Atrypa lævis Vaunexem, 1843: Rept. Third Dist. N. Y., p. 120, fig. 2.
Merista lævis Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 376, pl. vii, figs. 8a-c.

In general appearance like *Nucleospira pesiformis,* but much larger and longer.

Horizon and localities.—Upper Silurian limestone: Bailey landing (Perry county).

Eatonia peculiaris? (CONRAD).

Atrypa peculiaris Conrad, 1841: Ann. Rept. Pal. New York, p. 56.
Eatonia peculiaris Hall, 1859: Twelfth Ann. Rept. Reg. Univ. New York, p. 37, figs. 1-7.

Shell rather below medium size, slightly longer than wide. Dorsal valve more convex than the ventral; front elevated into a prominent median fold. Ventral valve flattened, beak arched, foramen terminal, small. Surface ornamented by small radiating ribs.

Horizon and localities.—Upper Silurian limestone: near Grand Tower, in Perry county.

Pentamerus ? salinensis SWALLOW.

Pentamerus salinensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 652.

Shell below medium size, ovoid. Ventral valve very convex, abruptly arching to the sides, beak somewhat extended, pointed, incurved; foramen large, triangular. Surface marked by about ten low plications, toward the anterior border.

Horizon and localities.—Devonian? Callaway? limestone: Moniteau county (Swallow).

Terebratula rowleyi Worthen.

Plate xii, fig. 23.

Terebratula rowleyi Worthen, 1884: Illinois State Mus. Nat. Hist., Bul. 2, p. 23.
Terebratula rowleyi Worthen, 1890: Geol. Sur. Illinois, vol. VIII, p. 102, pl. xi, figs. 6a–b.

A small flattened form, with extended beak.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Louisiana.

Terebratula bovidens Morton.

Terebratula bovidens Morton, 1836: Am. Jour. Sci., vol. XXIX, p. 150.
Terebratula millepunctata Hall, 1856: Pac. R. R. Sur., vol. III, p. 101, pl. ii, figs. 1 and 2.
Terebratula bovidens Hall, 1858: Geology Iowa, vol. I, p. 711.
Terebratula geniculosa McChesney, 1861: Desc. Pal. Foss., p. 82.
Terebratula bovidens McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 37, pl. i, fig. 2.
Terebratula bovidens Meek, 1872: U. S. Geol. Sur. Nebraska, p. 187, pl. i, figs 7a–c; pl. ii, fig. 4.
Dielasma bovidens White, 1875: Expl. and Sur. w. 100 Merid., Prelim. Rep. Invert. Foss., p. 21.
Terebratula bovidens White, 1875: U. S. Geog. Sur. w. 100 Merid., vol. IV, p. 144, pl. xi, figs. 10a–c.

Shell of medium size, ovoid. Ventral valve strongly arched, with the greatest convexity toward the apical portion; beak rather prominent, closely incurved; foramen elliptic; median sinus wide and quite shallow. Dorsal valve but slightly convex longitudinally, moderately arcuate transversely; mesial fold scarcely noticeable. Surface glabrate, with a few rather distinct concentric lines of growth, but under a magnifier exhibiting a punctate structure.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Terebratula parva Swallow.

Terebratula parva Swallow 1863: Trans. St. Louis Acad. Sci., vol. II, p. 83.

Shell very small, gibbous. Surface nearly smooth, or marked by fine radiating lines.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Keokuk (Iowa).

Spurious and Doubtful Species of Brachiopods.

Productus callawayensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 640. Too poorly defined for recognition.

Productus blairi Miller, 1892: Geol. Sur. Indiana, 17th Ann. Rept., Adv. sheets, p. 79, pl. xiii, figs. 16-17. Too imperfect for identification.

Orthis pratteni McChesney, 1859: Desc. New Species Foss. Palæ Rocks Western States, vol. I. Carbonic? Poorly defined.

Strophodonta altidorsata Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 637. Devonian: Callaway county. Insufficiently described.

Koninckina americana Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 94. St. Louis limestone: Barrett station, St. Louis county. Too imperfect for recognition.

Spirifera clarus Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 86. Keokuk limestone: Ste. Genevieve county. Cannot be recognized from description.

Spirifer meeki Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 645. Burlington limestone: Pettis county. Not recognizable.

Spirifer latior Swallow, 1860: Trans. St. Louis Acad. Sci., vol. II, p. 86. Chouteau limestone: Cooper county. Description too imperfect.

Spirifer annæ Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 641. Callaway limestone: Callaway county. Too imperfect to identify.

Spirifer amarus Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 642. Cannot be recognized.

Spirigera jacksoni Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 651. Upper Coal Measures: Cass county. Poorly defined. Probably identical with *S. lineatus*.

Spirigera missouriensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p 650. Coal Measures: Montgomery county. Poorly defined. Probably synonymous with *S. lineatus*.

Athyris ultravarica McChesney, 1859: Desc. New Species Foss. Palae. Rocks, Western States. Ste. Genevieve. Description too meager.

Spirigera maconensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 651. Coal Measures: Montgomery county. Cannot be recognized.

Spirigera platensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 87. Upper Coal Measures: northwestern Missouri. Not recognizable.

Spirigera missouriensis Winchell, 1865: Proc. Acad. Nat. Sci., Phila., p. 17. Lithographic limestone: Louisiana. Name preoccupied.

Retzia popenana Swallow, 1860: Trans. St. Louis Acad. Sci., vol I, p. 654. Not recognizable.

Rhynchonella warrenensis Swallow, 1860: Trans. St. Louis Acad Sci., vol. I, p. 653. Lower Devonian, Callaway county. Description too general.

Rhynchonella perrostellata Swallow, 1863: Trans. St. Louis Acad. Sci, vol. II, p. 85. Keokuk limestone: Cooper county. Not sufficiently defined.

Terebratula brevilobata Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 84. Keokuk limestone: Ste. Genevieve county. Cannot be identified.

Terebratula arcuata Swallow, 1863: Trans. St. Louis Acad. Sci., p. 83. Kaskaskia limestone: Ste. Genevieve county. Cannot be recognized.

Terebratula gracilis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 83. St. Louis limestone: St. Mary. Not recognizable.

CHAPTER XII.

LAMELLIBRANCHS.

Placunopsis carbonaria MEEK & WORTHEN.

Plate xliii, fig. 9.

Placunopsis carbonaria Meek & Worthen, 1866: Proc. Chicago Acad. Sci., vol. I, p. 13.

Placunopsis carbonaria Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 578, pl. xvii, figs. 2a-b.

Lenticular, compressed, shell very thin.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Lima retifera SHUMARD.

Plate xlii, fig. 1.

Lima retifera Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 214.

Lima retifera Geinitz, 1866: Carb. und Dyas in Nebraska, p. 36, tab. ii, figs. 20, 21.

Lima retifera Meek, 1872: U. S. Geol. Sur. Nebraska, p. 188, pl. ix, fig. 5.

Lima retifera White, 1884: Geol. Sur. Indiana, 13th Ann. Rept, pt. ii, p. 138, pl. xxviii, fig. 4.

Crenipecten retiferus Miller, 1890: N. A. Geol. and Pal., p. 473.

Lima retifera Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 248.

Shell rather small, subovate, moderately convex, regularly rounded below; anterior slope long, straight, forming an angle of about 140° with the hinge-line, sharply curved as it meets the ventral margin; posterior slope much shorter; hinge-line about one-third the length of the valves; ears subequal; umbones not prominent, and situated midway between the extremities of the hinge-line. Surface marked by from 20 to 25 rather angular radiating ribs, which are often crossed by transverse lines of growth.

Horizon and localities.—Upper Carboniferous, Coal Measures: Clinton (Henry county), Kansas City.

Entolium circulus (SHUMARD).

Avicula circulus Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 206, pl. C, figs. 14a–b.
Avicula circulus Hall, 1858: Geology Iowa, vol. I, p. 522, pl. vii, fig. 9.

Large, compressed, circular; hinge very short; surface smooth or marked by fine lines of growth.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Vandever Falls (Cooper county).

Entolium cooperensis (SHUMARD).

Avicula cooperensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 206, pl. C, fig. 15.

A small form somewhat resembling *E. circulus*, but with shorter hinge-line, and with distinct radiating ribs.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Vandever Falls (Cooper county).

Entolium aviculatum (SWALLOW).

Plate xiii, figs. 2a-b.

Pecten aviculatus Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 125.
Entolium aviculatum Meek, 1872: U. S. Geol. Sur. Nebraska, p. 189, pl. ix, figs. 11a–f.
Entolium aviculatum White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 142, pl. xxviii, figs. 7-8.

Shell compressed, very thin, equivalve, subcircular in outline, with small subequal ears; anterior and posterior slopes straight, equally inclined to the hinge-line, and forming at the beak an angle of about 120° with each other; hinge-line short. A shallow depression extends from the umbones to the front and back margins of each valve. Surface ornamented by minute concentric lines, which are often crossed by faint radiating striations.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Aviculopecten magna (SWALLOW).

Plate xliii, fig. 7.

Avicula magna Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 98.

Shell very large, heavy, subcircular in outline; anterior and ventral margins regularly rounded; hinge-line straight, long, nearly equaling the length of the valves. Left valve quite convex, especially toward the umbo; beak gibbous, extending slightly beyond the hinge-line; posterior ear short; anterior ear greatly extended. Surface marked by rather large, rounded costæ radiating from the beak, and widely separated from one another; these are crossed by lines of growth, often somewhat imbricated.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Springfield (Greene county).

Aviculopecten missouriensis (SHUMARD).

Pecten missouriensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 207, pl. C, fig. 16.

A small form similar to *A. occidentalis*, but having relatively larger ribs.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Aviculopecten occidentalis (SHUMARD).

Plate xlii, fig. 8.

Pecten occidentalis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 207, pl. C, fig. 18.

Pecten cleavelandicus Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 184.

Aviculopecten occidentalis? Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 331, pl. xxvii, figs. 4, 5.

Pecten missouriensis? Geinitz, 1866: Carb und Dyas in Nebraska, p. 35, tab. ii, fig. 18. (Not Shumard, 1855.)

Aviculopecten occidentalis Meek, 1872: U. S. Geol. Sur. Nebraska, p. 191, pl. ix, fig. 10.

Aviculopecten occidentalis White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 143, pl. xxviii, fig. 3.

Shell of medium size, inequivalve, symmetrical, higher than long, regularly rounded below; hinge-line as long as the greatest length of valves. Left valve decidedly convex; other one

nearly flat. Ears subequal; the anterior somewhat smaller than the posterior, and with much more conspicuous radiating costæ. Surface marked by low radiating ribs, of which there are about fifteen, that extend from the umbo to the margins, the others disappearing as they approach the beaks. These are crossed by numerous fine, often imbricated, lines of growth. All the surface markings are much more prominent on the left valve than on the right.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Plattsburg (Clinton county), Kansas City.

Aviculopecten carboniferus (STEVENS).

Plate xliii, figs. 4a-b.

Pecten carboniferus Stevens, 1858: Am. Jour. Sci., (2), vol. XXV, p. 261.
Pecten broadheadi Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 97.
Pecten hawni Geinitz, 1866: Carb. und Dyas in Nebraska, p. 36, tab. ii, figs. 19a-b.
Aviculopecten carboniferus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 193, pl. ix, figs. 4a-b.
Aviculopecten carboniferus White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 144, pl. xxxviii, figs. 5-6.

Shell rather small, oblique, moderately convex, length and breadth nearly equal; hinge-line nearly or quite straight, and somewhat less in length than the greatest breadth of the valves, provided with a marginal ridge in both valves; basal margin regularly rounded. Left valve more convex than the other; posterior ear rather well defined from the swell of the umbo, somewhat extended and terminating in an acute point, separated from the margin below by deep rounded sinus; anterior ear about two-thirds as long as the other, and rather more distinct from the umbo and more obtuse, but still rather acutely angular; defined by a moderately distinct subangular sinus. Right valve nearly flat, or distinctly less convex than the other; its anterior ear narrow, and defined by a deep, rather sharp sinus; posterior ear of the same size and form as in the left valve. Surface ornamented in the left valve with about fifteen or sixteen distinct, angular, radiating plications, separated by furrows of the same size, each one of which terminates

at the free border in a little spine-like projection with curved-up margin; lines of growth fine on the body of the valve, but becoming more distinct and irregular on the ears, where there are rarely any defined radiating costæ. At a few distantly separated intervals there are prominent imbricating laminæ of growth, showing the same digitate markings as the free borders of the shell. In the right valve the surface markings are somewhat like those of the other valve, but much more obscure, excepting on the anterior wing, where there are a few more distinct radiating costæ. (Meek.)

Horizon and localities —Upper Carboniferous, Upper Coal Measures: Kansas City.

Aviculopecten coxanus MEEK & WORTHEN.

Aviculopecten coxanus Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 453.

Aviculopecten coxanus Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 326, pl. xxvi, figs. 6a-b.

Aviculopecten coxanus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 196, pl. ix, figs. 2a-b.

Aviculopecten coxanus Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 232.

Shell like *A. occidentalis* Shumard, but very much smaller, thinner, and proportionally longer; ribs larger and further apart; posterior slope considerably longer than the anterior.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Aviculopecten? interlineatus MEEK & WORTHEN.

Plate xlii, fig. 6.

Aviculopecten interlineatus Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 454.

Aviculopecten interlineatus Meek & Worthen, 1868: Geol. Sur. Illinois, vol. II, p. 329, pl. xxvi, figs. 7a-b.

Aviculopecten? interlineatus White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 145, pl. xxx, fig. 9.

A small subcircular form, with long straight hinge-line; and characterized especially by prominent, rather distant concentric ridges.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Kansas City.

Aviculopecten coryanus White.

Aviculopecten coryanus White, 1874: Expl. and Sur. w. 100 Merid., Prelim. Rep. Invert. Foss., p. 21.
Aviculopecten coryanus White, 1877: U. S. Geog. Sur. w. 100 Merid., vol. IV, p. 147, pl. xi, figs. 1a-b.

Like *A. occidentalis*, but much larger, less contracted below the ears, and with coarser radiating ribs.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Aviculopecten fasciculatus Keyes.

Plate xiii, fig. 7.

Shell large, similar to *A. providensis* (Cox). The ribs small, in bundles of from three to four, with broad channels between contiguous fascicles.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Avicula longa (Geinitz).

Gervillia longa Geinitz, 1866: Carb. und Dyas in Nebraska, p. 32, tab. ii, fig. 15.
Avicula longa Meek, 1872: U. S. Geol. Sur. Nebraska, p. 199, pl. ix, fig. 8.
Avicula longa Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 578, pl. xxvi, fig. 1.
Avicula longa Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 248.

Shell rather below medium size, obliquely elongate, nearly equivalve, with a long posterior ear and a much shorter front extension. Anterior end rather acutely pointed above, sloping sinuously backward to the nearly straight basal margin; posterior extremity sharply rounded below. Hinge-margin straight, about two-thirds the length of the valves, and extended behind into a long narrow wing, producing a deep, rounded sinus between it and the body of the shell. Forward ear broad, somewhat triangular. Beaks rather prominent, situated about one-fourth of the entire length of the hinge-line from the forward end of the shell. Surface glabrate, with often fine concentric lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Monopteria gibbosa (MEEK & WORTHEN),

Plate xliii, figs. 2a-b.

Pterinea (Monopteria) gibbosa Meek & Worthen, 1866: Trans. Chicago Acad. Sci., vol. I, p. 20.

Monopteria gibbosa Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 340, pl. xxvii, figs. 11-11b.

Monopteria gibbosa White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., pt. ii, p. 139, pl. xxx, figs. 11-12.

Shell suborbicular in outline, gibbous, regularly curved along the anterior and basal margins; posterior margin produced backward, the umbonal ridge extending from the beak to this rounded angularity. Hinge-line straight, somewhat shorter than greatest length of valves, the posterior alate projection rather long, slender, compressed, with a deep sinus below, separating it from the valves beneath. Anterior ear very small. Surface marked only by fine concentric lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: .Kansas City.

Monopteria longispina (COX).

Plate xliii, fig. 1.

Gervillia longispina Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 568, pl. viii, fig. 6.

Gervillia auricula Stevens, 1858: Am. Jour. Sci., (2), vol XXV, p. 265, p. 38.

Pterinea (Monopteria) longispina Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 341.

Like *M. gibbosa*, but very much more oblique, the posterior angle much more produced, the beaks placed more forward.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Monotis? gregaria MEEK & WORTHEN.

Monotis? gregaria Meek & Worthen, 1870: Proc. Acad. Nat. Sci., Phila.

Monotis? gregaria Meek & Worthen, 1875: Geol. Sur. Illinois, vol. V, p. 573. pl. xxvi, figs. 5a-b.

A very small, thin, rounded shell, like Aviculopecten, but without the ears defined.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Enchondria neglecta (GEINITZ)

Pecten neglectus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 56, tab. iii, fig. 7.
Aviculopecten neglectus Meek, 1867: Am. Jour. Sci., (2), vol. XLV, p. 64.
Aviculopecten neglectus Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 589, pl. xxvi, figs. 7a-b.
Enchondria neglecta Meek, 1874: Am. Jour. Sci., (3), vol. VII, p. 445.
Aviculopecten neglectus Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 232.

A small form like an Entolium in general appearance, but with large ribbed ears, and crenulated cardinal margin.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Aviculopinna americana MEEK.

Avicula pinnæformis Geinitz, 1866: Carb. und Dyas in Nebraska, p. 31, tab ii, fig. 13. (Not *A. pinnæformis*, Geinitz, 1857.)
Aviculopinna americana Meek, 1867: Am. Jour. Sci., (2), vol. XLIV, p. 282.
Aviculopinna americana Meek, 1872: U. S. Geol. Sur. Nebraska, p. 197, pl. ix, figs. 12a-d.

Shell small, compressed, with the slender elongated form of some of the Carboniferous species of Pinna; cardinal and ventral margins generally nearly straight (the latter being the more convex in outline) and converging gradually from behind to the rather obtusely pointed anterior extremity; posterior side truncated, rounding to the base, and intersecting the posterior extremity of the hinge very nearly at right angles; a little sinuous just below the extremity of the hinge. Cardinal margin so slightly convex in outline as to appear quite straight, very nearly equaling the greatest length of the valves, and provided with a well-defined marginal ridge, which narrows to a mere line, or dies out before reaching the beaks, and widens very gradually to the posterior extremity. Beaks nearly or quite obsolete, extremely oblique, and very slightly behind the very narrow, obtusely pointed anterior extremity. Surface with two or three broad, nearly obsolete radiating ridges on the posterior dorsal region, and ornamented by numerous slender, very regularly disposed and abruptly elevated lines of lamellæ, much narrower than the space between and curving gracefully

parallel to the posterior border; while on the basal half of the valves they are closely approximate and curve forward.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Forest City (Holt county).

Pinna missouriensis Swallow.

Pinna missouriensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 97.

A rather large shell with radiating ridges on the posterior slopes.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Ste. Genevieve.

Pinna peracuta Shumard.

Plate xlv, figs. 2a-b.

Pinna peracuta Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 214.
Pinna peracuta Meek, 1872: U. S. Geog. and Geol. Sur. Nebraska, p. 198, pl. vi, figs. 11a-b.
Pinna peracuta White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 145, pl. xxviii, figs. 1-2.

Shell attaining a large size, very convex or somewhat cylindrical, flattened behind; hinge-line straight; ventral margin nearly straight; posterior rounded. Surface smooth, or marked only by lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Lithophaga sp?

Plate xliii, figs. 3a-b.

Shell moderately long, very ventricose, compressed and sharply rounded posteriorly; hinge-line straight, about two-thirds as long as the valves; beaks obtuse, terminal. Surface marked only by closely arranged lines of growth.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Louisiana.

Lithophaga pertenuis MEEK & WORTHEN.

Lithophaga? pertenuis Meek & Worthen, 1865: Proc. Acad. Nat. Sci., Phila., p. 245.

Lithophaga? pertenuis Meek & Worthen, 1875: Geol. Sur. Illinois, vol. V, p. 539, pl. xxii, figs. 1a-b.

Much larger and less robust than the species figured; surface smooth, with only fine lines of growth.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Myalina keokuk WORTHEN.

Myalina keokuk Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 524, pl. xxx, fig. 5.

Like *M. angulata*, but with stout beaks and heavier valves.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Bonaparte (Iowa); St. Francisville (Clark county).

Myalina sancti-ludovici WORTHEN.

Myalina sancti-ludovici Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 540, pl. xxii, fig. 3.

Closely related to *M. angulata*, but much smaller and more delicate.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Myalina kansasensis SHUMARD.

Plate xliii, fig. 5.

Myalina kansasensis Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 213.

Closely related to *M. recurvirostris* M. & W., but with the concentric lamillæ prominently corrugated.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Myalina recurvirostris MEEK & WORTHEN.

Plate xlv, figs. 1a-b.

Myalina recurvirostris Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 456.

Myalina recurvirostris Meek & Worthen, 1866: Geol. Sur. Illinois, vol II, p. 344, pl. xxvi, figs. 9a-c.

Myalina recurvirostris White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., pt. ii, p. 140, pl. xxix, figs. 3-4.

Similar to *M. swallowi* but inequivalve, very much larger, heavier, and with the beaks incurved; surface with somewhat imbricated lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Myalina perattenuata Meek & Hayden.

Myalina perattenuata Meek & Hayden, 1858: Trans. Albany Institute, vol. IV, p. 77.

Myalina perattenuata Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 582, pl. xxvi, fig. 11.

Shell rather small, with sharp, protruding beaks, and broadly rounded posterior margin.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Myalina angulata Meek & Worthen.

Myalina angulata Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 455.

Myalina angulata Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 300, pl. xxiii, figs. 7a-b.

Shell quite large, with extended, compressed beaks, and subalate dorsum.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Myalina subquadrata Shumard.

Plate xliv, figs. 1a-b and 2a-b.

Myalina subquadrata Shumard, 1855: Geol. Sur. Missouri, Ann. Rept., p. 207, pl. C, fig. 17.

Myalina subquadrata Geinitz, 1866: Carb. und Dyas in Nebraska, p. 27, tab. iii, figs. 25-26.

Myalina subquadrata Meek, 1872: U. S. Geol. Sur. Nebraska, p. 202, pl. iv, fig. 12; and pl. ix, fig. 6.

Myalina subquadrata White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., pt. ii, p. 140, pl. xxix, figs. 1-2.

Shell large, massive, oblong, somewhat higher than long, winged above the posterior umbonal slope. Hinge-line straight, as long as the greatest length of valves; below regularly curved; anterior border somewhat concave above; posterior margin nearly straight, vertical. Beaks terminal. Cardinal

area broad with well-defined furrows. Surface marked by fine concentric lines of growth and imbricated lamellæ.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Myalina swallovi McChesney.

Plate xliii, figs. 3a-c.

Myalina swallovi McChesney, 1859: Desc. New Species Foss., p. 57.

Myalina swallovi Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 341, pl. xxvii, fig 1.

Myalina swallovi McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 4, pl. ii, fig. 6.

Ancella hausmanni Geinitz, 1866: Carb und Dyas in Nebraska, p. 25, tab. ii, fig. 8. (Not Goldfuss, 1834.)

Myalina? swallovi Meek, 1875: U. S. Geol. Sur. Nebraska, p. 201, pl. ix, figs. 7a-b.

Myalina? swallovi White, 1884: Geol. Sur. Indiana, Report for 1883, p. 141, pl. xxx, figs. 6, 7, 8.

Myalina swallovi Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 232.

Shell rather small, nearly or quite equivalve, modioliform or mytiloid, convex, or even subangular, along the umbonal slopes from the beaks to the anterior basal margin; posterior and postero-dorsal regions cuneate; cardinal border nearly straight, and about one-half the length of the valves, passing almost imperceptibly, or without any angularity, into the posterior margin, which rounds down with a semicircular curve to the narrowly rounded basal extremity; antero-basal border ascending obliquely forward, more or less sinuous near the middle, or sometimes a little above, usually swelling out into a kind of lobe or protuberance above the middle in front of the umbonal slope. This prominence sometimes extends a little beyond the beaks and varies more or less in breadth. Beaks small, very oblique, not projecting beyond the cardinal margin, and located so near the anterior extremity as often to appear very nearly terminal. Surface rather smooth, but showing fine concentric lines, which in well-preserved specimens are sometimes crossed by very fine, obscure traces of radiating striations that curve upward on the posterior dorsal region. (Meek.)

Horizon and localities — Upper Carboniferous, Lower Coal Measures: Carbonier (Saint Louis county); Upper Coal Measures: Richmond (Ray county), Kansas City.

Macrodon tenuistriatus MEEK & WORTHEN.

Arca striata Geinitz, 1866: Carb. und Dyas in Nebraska, p. 20, tab. i, fig. 32. (Not *Mytilites striatus*, Schlotheim, 1819.)
Macrodon tenuistriatus Meek & Worthen, 1867: Trans. Chicago Acad. Sci., vol. I, p. 17.
Macrodon tenuistriatus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 207, pl. x, figs. 20a-b.

Shell small, rhombic oblong, rather distinctly convex, along the umbonal slopes, and near the front a little more than twice as long as high; basal and cardinal margins parallel; the former nearly straight, or somewhat sinuous near the middle; cardinal margin straight, not quite equaling the greatest antero-posterior diameter; anterior side rounding up from below so as to meet the hinge nearly at right angles; posterior basal margin narrowly rounded; posterior margin obliquely truncated, often a little sinuous above; dorsal region behind the umbonal slope compressed; beaks convex, a little flattened, incurved, and rising somewhat above the hinge margin, located about half-way between the middle and the front; flanks broadly impressed or concave from the umbonal regions obliquely backward to the faintly sinuous part of the base; cardinal area unknown; posterior linear teeth about three; surface ornamented with distinct marks of growth crossed by radiating markings, which on the compressed posterior dorsal region form rather well-defined radiating lines; anteriorly, however, these diminish in size so as to become very minute or scarcely visible, crowded, obsolescent striæ. (Meek.)

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Macrodon obsoletus MEEK.

Plate xlvi, fig 1.

Macrodon obsoletus Meek, 1871: Rep. Reg. Univ. West Virginia, p. 5.
Macrodon obsoletus Meek, 1875: Geol. Sur. Ohio, Pal., vol. II, p. 334, pl. xix, fig. 9.
Macrodon obsoletus Keyes, 1891: Proc. Acad. Nat. Sci., Phila, p. 249.

Shell considerably larger than *M. tenuistriatus*, and with the radiating lines poorly defined or absent.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

The bivalve under consideration was originally described from the Appalachian region, where it appears to be rather widely distributed through Pennsylvania, West Virginia and Ohio. It has only recently been recognized west of the Mississippi river. The western shells are somewhat larger than those from the eastern localities, but do not differ essentially from the typical forms of the genus. Meek's type specimen was a good example, showing the specific characters perfectly.

Macrodon sangamonensis? Worthen.

Plate xlvi, fig. 2.

Macrodon sangamonensis Worthen, 1890: Geol. Sur. Illinois, vol. VIII, p. 123, pl. xxi, fig. 3.

Similar to *M. obsoletus*, but smaller, and with radiating ribs.

Horizon and localities.— Upper Carboniferous, Upper Coal Measures: Kansas City.

Nucula parva McChesney.

Nucula parva McChesney, 1860: Desc. New Pal. Foss., p. 51.

Nucula parva McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 39, pl. ii, figs. 8a–c.

Nucula parva Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 589, pl. xxvi, figs. 8a–b.

Nucula parva Keyes, 1888: Proc. Acad. Nat. Sci., Phil., p. 250.

Nucula parva Keyes, 1891: Johns Hopkins Univ. Circulars, vol. XI, p. 29.

A very small shell, differing from *N. ventricosa*, not only in size, but in the long, posterior slope, and marked concentric lines of growth.

Horizon and localities—Upper Carboniferous, Upper Coal Measures: Kansas City.

Nucula ventricosa Hall.

Plate xlv, figs. 3a-b.

Nucula ventricosa Hall, 1858: Geology Iowa, vol. I, p. 716, pl. xxix, figs. 4, 5a–b.

Nucula ventricosa Meek, 1872: U. S. Geol. Sur. Nebraska, p. 204, pl. x, figs. 17a-c.

Nucula ventricosa White, 1882: Geol. Sur. Indiana, Rept. for 1881, p. 371, pl. xlii, figs. 9, 10.

Nucula ventricosa White, 1884: Geol. Sur. Indiana, Rept. for 1883, p. 146, pl. xxvii, figs. 9, 10.

Nucula ventricosa Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 233.
Nucula ventricosa Keyes, 1891: Johns Hopkins Univ. Circulars, vol. XI, p. 29.

Shell rather small, thick, subovoid, with the greatest breadth slightly in front of the middle; anterior margin short, straight, or a little concave, rather sharply rounded below; posterior end but slightly produced, somewhat narrowly rounded; basal margin broadly and regularly curved. Beaks well defined, and situated a little in front of the middle of the valves. Surface nearly smooth, with a few lines of growth plainly discernible.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Clinton (Henry county); Upper Coal Measures: Kansas City, Gentry (Gentry county).

Nuculana bellistriata STEVENS.

Plate xlv, figs. 4a–b.

Leda bellistriata Stevens, 1858: Am. Jour. Sci., (2), vol. XXV, p. 261.
Leda bellistriata Hall, 1858: Geology Iowa, vol. I, p. 717, pl. xxix, figs. 6a–d.
Nucula kazanensis Geinitz, 1866: Carb. und Dyas in Nebraska, p. 20, tab. i, figs. 33–34 (Not *N. kazanensis* de Verneuil, 1845.)
Nuculana bellistriata, var. *attenuata* Meek, 1872: U. S. Geol. Sur. Nebraska, p. 206, pl. x, figs. 11a–b.
Nuculana bellistriata White, 1884: Geol. Sur. Indiana, Rep. 1883, p. 146, pl. xxxi, figs. 8–9.
Nuculana bellistriata Keyes, 1888: Proc. Acad. Nat. Sci., Phil., p. 233.
Nuculana bellistriata Keyes, 1891: Johns Hopkins Univ. Circulars, vol. XI, p. 89.

Shell rather small, subovoid, extended behind; umbonal regions more or less ventricose, compressed posteriorly, with the umbonal slope quite angular; regularly rounded below and in front, attenuated behind. Cardinal border in front of the beaks arched; behind concave, a little elevated or ridged, leaving the umbonal slope more or less depressed in the middle. Beaks rather prominent. Surface marked by numerous well-defined concentric thread-like ribs, which are scarcely noticeable after passing the prominent umbonal carina.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Gentry (Gentry county), Kansas City.

Yoldia subscitula (Meek & Hayden).

Leda subscitula Meek & Hayden, 1858: Trans. Albany Inst., vol. IV, p. 79.

Yoldia subscitula Meek & Hayden, 1864: Pal. Upper Missouri, pt. i, p. 60, pl. ii, figs. 4a–b.

Nucula (*Leda*) *subscitula?* Geinitz, 1866: Carb. und Dyas in Nebraska, p. 22, tab. i, fig. 35.

Yoldia subscitula Meek, 1872: U. S. Geol. Sur. Nebraska, p. 205, pl. x, fig. 10.

A small, smooth shell, not unlike a *N. bellistriata* in general appearance, but without the attenuated posterior margin, and with crenate hinge.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Schizodus wheeleri (Swallow).

Plate xlvi, figs. 3a-c.

Cydricardia wheeleri Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 96.

Schizodus obscurus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 20, tab. i, figs. 30, 31. (Not Sowerby, 1821.)

Schizodus wheeleri Meek, 1872: U. S. Geol. Sur. Nebraska, p. 209, pl. x, figs. 1a-d.

Schizodus wheeleri White, 1884: U. S. Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 147, pl. xxx, figs. 3-5.

Shell of medium size, longitudinally subovoid, moderately ventricose; regularly curved in front; narrow and obliquely truncated behind; evenly rounded below; cardinal border straight, inclined slightly backward. Beaks not prominent, situated midway between the anterior and middle of the valves; posterior umbonal slope rather well marked by a low rounded. ridge. Surface smooth, marked only by faint lines of growth

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Schizodus harii Miller.

Plate xlvi, fig. 4.

Schizodus harii Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep, Adv. sheets, p. 91, pl. xx, figs. 1-3.

Larger, shorter and heavier than *S. wheeleri*.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Schizodus? curtus Meek & Worthen.

Schizodus rossicus Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 193. (Not *S. rossicus* de Verneuil.)

Schizodus curtus Meek & Worthen, 1865: Trans. Chicago Acad. Sci, vol. I, p, 18.

Schizodus rossicus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 18, tab. i, fig. 28. (Not *S. rossicus* de Verneuil.)

Schizodus curtus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 208, pl. x, figs. 13a–e.

A small suborbicular form, with nearly smooth surface.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Chonocardium sp.?

A small form of this genus has been found in the "white chert" layers near the base of the Burlington limestone, at Louisiana. The specimens are not now accessible.

Conocardium parrishi Worthen.

Plate xlvi, figs. 6a–b.

Conoacrdium parrishi Worthen, 1890: Geol. Sur. Illinois, vol. VIII, p. 112, pl. xx, fig. 7.

Shell trigonal, cardinal line straight; umbonal ridge sloping forward. Surface costate.

Horizon and localities—Upper Carboniferous, Upper Coal Measures: Kansas City.

Clinopistha radiata (Hall).

Plate xlvi, figs. 11a–b.

Edmondia radiata Hall, 1858: Geology Iowa, vol. I, p. 716, pl. xxix, fig. 3.

Clinopistha radiata Meek & Worthen, 1870: Proc. Acad. Nat. Sci., Phila., p. 44.

Clinopistha radiata var. *lævis* Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 384, pl. xxvii, fig. 7.

Clinopistha radiata White, 1884: Geol. Sur. Indiana, Rep. 1883, p. 147, pl. xxxi, figs. 6–7.

Clinopistha radiata Keyes, 1888: Proc. Acad. Nat. Sci, Phila, p. 233.

Clinopistha radiata Keyes, 1891: Johns Hopkins Univ. Circulars, vol. VI, p. 29.

Shell subovate in outline, moderately convex; beaks blunt; cardinal margin straight, slightly curved downward posteriorly. Surface glabrate, often with obscure radiating lines.

Horizon and localities—Upper Carboniferous, Lower Coal Measures: Clinton (Henry county).

Pleurophorus oblongus MEEK.

Pleurophorus pallasi Geinitz, 1866: Carb. und Dyas in Nebraska, p. 23, tab. ii, fig. 4. (In part.)
Pleurophorus oblongus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 212, pl. x, figs. 4a–c.

Shell small, longitudinally oblong, about twice as long as high, moderately convex, particularly along the umbonal slopes from the beaks to the posterior basal margin, but without any defined angle or ridge there; cardinal margin nearly straight, and subparallel to the base, about equaling two-thirds the entire length of the valves; basal margin more or less distinctly sinuous near the middle, at the termination of a broad, oblique impression or concavity, extending from the anterior side of the beaks, under the umbonal slopes, to the lower margin; anterior margin narrowly rounded below; posterior side much wider, rounded, or sometimes obliquely subtruncated above; beaks convex, very oblique, obtuse, located one-seventh to one-eighth the length of the valves behind the anterior extremity; surface with apparently only fine concentric marks of growth; muscular impressions faintly marked; ridge behind the anterior one small; posterior lateral tooth slender and elongated.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Astartella vera HALL.

Plate xlvi, fig. 6.

Astartella vera Hall, 1858: Geology Iowa, vol. I, p. 715, pl. xxix, figs. 3a-c.
Astartella vera Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 250.
Astartella vera Keyes, 1891: Johns Hopkins Univ. Circulars. vol. XI, p. 29.

Shell subquadrate, with beaks somewhat elevated, situated over the anterior margin, which is regularly rounded; posterior margin truncated. Surface smooth, with concentric wrinkles and fine lines of growth; cardinal teeth stout.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Clinton (Henry county).

Astartella concentrica (McChesney).

Edmondia concentrica McChesney, 1859: Desc. New Species Foss. Palæ. Rocks Western States, p. 55.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Charbonier (Saint Louis county).

Edmondia nuptialis Winchell.

Plate xlvii, fig. 2.

Edmondia nuptialis Winchell, 1863: Proc. Acad. Nat. Sci., Phila., p. 12.

A rather small form, circular in outline, with the beaks rather well forward.

Horizon and localities.—Lower Carboniferous, Lower Burlington limestone: Louisiana.

Edmondia burlingtonensis White & Whitfield.

Plate xlvii, fig. 3.

Edmondia burlingtonensis White & Whitfield, 1862: Proc. Boston Soc. Nat. Hist., vol. VIII. p. 301.

Rather below medium size, elliptic in outline; hinge-line long, nearly straight; beaks set well toward the anterior end.

Horizon and localities.—Lower Carboniferous, Lower Burlington limestone: Louisiana.

Edmondia aspinwallensis Meek.

Plate xlvii, figs. 1a-b.

Edmondia aspinwallensis Meek, 1871: U. S. Geol. Sur. Terr. Wyoming, p. 299.

Edmondia aspinwallensis Meek, 1872: U. S. Geol. Sur. Nebraska, p. 216, pl. iv, figs. 2a–c.

Edmondia aspinwallensis White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 148, pl. xxxi, figs. 4-5.

Shell subovate, moderately ventricose; cardinal margin nearly straight, slightly curving downward posteriorly; beaks somewhat depressed, incurved, and situated toward the anterior. Surface smooth, with low, undulatory, concentric folds, and fine lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Edmondia subtruncata MEEK.

Edmondia subtruncata Meek, 1872: U. S. Geol. Sur. Nebraska, p. 215, pl. ii, fig. 7.

Closely approaching *E. aspinwallensis*, but more subquadrate in outline, and with the umbonal region more inflated.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Kansas City.

Edmondia glabra MEEK.

Edmondia glabra Meek, 1872: U. S. Geol. Sur. Nebraska, p. 214, pl. x, figs. 7a-b.

Quite small, with large beaks medially located.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Allorisma hannibalensis SHUMARD.

Allorisma hannibalensis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 206, pl. C, fig. 19.

Closely resembling *A. subcuneata*, but very much smaller, and with prominent, concentric carinæ at broad intervals.

Horizon and localities.—Lower Carboniferous, Louisiana (Lithographic) limestone: Hannibal.

Allorisma marionensis WHITE.

Allorisma marionensis White, 1876: Proc. Acad. Nat. Sci., Phila., p. 31.
Allorisma marionensis White, 1883: U. S. Geol. Sur. Territories, 12th Ann. Rep., p. 167, pl. xli, figs. 3a-b.

A miniature of *A. subcuneata.*

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Allorisma antiqua SWALLOW.

Allorisma antiqua Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 95.

A small form with prominent concentric wrinkles.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Ste. Genevieve.

Allorisma costata MEEK & WORTHEN.

Plate xlvi, fig. 12.

Allorisma costata Meek & Worthen, 1869: Proc. Acad. Nat. Sci., Phila., p. 171.

Allorisma costata Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 585, pl. xxvi, fig. 15.

Shell small, elongate, length from two to three times the height; thin, convex in the umbonal regions; anterior margin short, evenly rounded; posterior end compressed, truncated. Surface ornamented by sharp, distant concentric ridges, which extend backward to the well-defined umbonal carinæ.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Allorisma topekaensis (SHUMARD).

Leptodomus topekaensis Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 208.

Very closely related to *A. granosum,* and perhaps identical with that species.

Horizon and localities.—Lower Carboniferous, Upper Coal Measures: Kansas City.

Allorisma granosum (SHUMARD).

Leptodomus granosus Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 207.

Allorisma granosum Meek, 1872: U. S. Geol. Sur. Nebraska, p. 220, pl. ii, fig. 8.

Shell very thin; approaching an irregularly oblong form, the length being less than twice the height; very convex, the most gibbous part being near the middle of the valves; beaks prominent, incurved, somewhat flattened on the outside, and placed about half way between the middle and the front. Dorsal margin straight behind the beaks and nearly parallel to the general outline of the base, inflected so as to form a distinct, flattened, lanceolate, lunule-like area, bounded on each side by a well-defined, sub-angular ridge; posterior side nearly or quite closed, obliquely truncated, with sometimes a faint sinuosity near the middle; anterior side rather abruptly sloping forward, straightened above, and rounding into the base below,

near which it seems to be a little gaping; base somewhat straightened, or even a little sinuous in outline, just in front of the middle, at the termination of a broad, very shallow concavity extending obliquely downward and backward from the umbonal region; behind this rather prominent, thence ascending obliquely, with a slightly convex outline, to the truncated posterior margin. Posterior umbonal slopes very prominently rounded above, and continued as a low, undefined ridge, obliquely backward and downward; posterior dorsal slope, above the umbonal ridge, with an oblique, shallow, rounded sulcus, extending from the back part of the beaks to the middle of the truncated margin behind. Surface marked with fine lines of growth and small, irregular, concentric wrinkles, which latter are not defined on the posterior dorsal region above the umbonal ridge; crossing these are the usual radiating rows of minute granules. (Meek.)

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Allorisma subcuneatum Meek & Hayden.

Allorisma subcuneatum Meek & Hayden, 1858: Proc. Acad. Nat. Sci., Phila., p. 263.
Allorisma ensiformis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. I, p. 656.
Allorisma subcuneatum Meek & Hayden, 1864: Pal. Upper Mo., p. 37, pl. i, figs. 10a-b.
Allorisma subcuneatum Geinitz, 1866: Carb. und Dyas in Nebraska, p. 76.
Allorisma subcuneatum Meek, 1872: U. S. Geol. Sur. Nebraska, p. 221, pl. ii, figs. 13a-b.

Shell large, two or three times as long as high, with greatest breadth in front of the middle, gaping slightly behind. Upper border nearly straight, flattened immediately behind the beaks so as to form a long lanceolate area, with subangular margins; between these angularities and the low, scarcely defined umbonal ridges there is a narrow, shallow depression in each valve. Basal margin nearly parallel to dorsal, slightly curved. Anterior border short, regularly rounded, a little gaping. Beaks large, prominent, incurved, and placed well for-

ward. Surface marked only by low concentric folds and fine lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Solenopsis solenoides (GEINITZ).

Clidophorus solenoides Geinitz, 1866: Carb. und Dyas in Nebraska, p. 25, tab. ii, fig. 7.

Solenopsis solenoides Meek, 1872: U. S. Geol. Sur Nebraska, p. 223, pl. x, fig. 3.

Shell small, rather compressed, elongated, the length being about four times the height, narrowing posteriorly; cardinal margin nearly straight, erect, less than the entire length of the valves, with a faint external compression or shallow furrow just below it; basal margin broadly convex in outline, the most prominent part being in advance of the middle; beaks much depressed and compressed, or scarcely distinct from the cardinal margin, placed within about one-eighth the entire length of the shell from the anterior extremity, and defined in front by a short vertical indentation; anterior side narrowly rounded, or with the upper side sometimes faintly truncated, with a slight slope from the little indentation forward. Surface with fine, regular striæ of growth, which are nearly or quite obsolete, excepting on the lower half of the valves.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Chænomya minnehaha (SWALLOW).

Allorisma minnehaha Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 193.

Chænomya minnehaha Meek & Hayden, 1864: Pal. Upper Mo., p. 43.

Chænomya minnehaha Meek, 1872: U. S. Geol. Sur. Nebraska, p. 217, pl. ii, figs. 13a-b.

Shell of medium size, obliquely elliptic in outline, ventri cose; anterior border rather sharply rounded above; posterior margin truncated, narrowly curved below, gaping broadly; cardinal border curved. Beaks rather prominent, depressed, somewhat incurved, and well forward. Posterior umbonal slopes prominent.

Horizon and localities —Upper Carboniferous, Upper Coal Measures: Kansas City.

Chænomya leavenworthensis (Meek & Hayden).

Allorisma leavenworthensis Meek & Hayden, 1858: Proc. Acad. Nat. Sci., Phila., p. 263.

Chænomya leavenworthensis Meek, 1864: Pal. Upper Missouri, p. 43, pl. ii, figs. 1a–c.

Chænomya leavenworthensis Meek, 1872: U. S. Geol. Nebraska, p. 216, pl. ii, fig. 9.

Somewhat smaller than *C. minnehaha*, and having the beaks set farther back than in that species.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Cardiomorpha triangulata Swallow.

Cardiomorpha triangulata Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 655.

Somewhat larger than *C. missouriensis*, and more triangular in outline.

Horizon and localities —Lower Carboniferous, Chouteau (Kinderhook) limestone: Cooper county.

Cardiomorpha missouriensis Shumard.

Cardiomorpha missouriensis Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 207.

Shell small, like an *Allorisma* in general appearance, but having larger umbonal regions.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Charboniere (St. Louis county), Lexington (Lafayette county).

Spurious and Doubtful Species.

Allorisma cuneata Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p 210. Coal Measures: Lexington. Not recognizable.

Allorisma lata Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 650. Coal Measures: Lexington. Cannot be identified.

Aviculopecten williamsi Meek, 1871: Proc. Acad. Nat. Sci., Phila., p. 178. Chouteau limestone: Chouteau Springs. Cannot be identified.

Cardinia occidentalis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 665. Chouteau limestone: Cooper county. Not recognizable.

Cardium lexingtonensis Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 206. Coal Measures: Lexington. Poorly defined.

Cypricardinella gorbyi Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rept., Adv. sheets, p. 92. Keokuk limestone: Boonville. Probably synonymous with species already described.

Cypricardia plicatula Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 205. Coal Measures: Platte county. Cannot be recognized.

Cypricardia pikensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 95. Coal Measures: Pike county. Poorly defined.

Cypricardia occidentalis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 96. Not recognizable.

Cypricardia chouteauensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 96. Chouteau limestone: Cooper county. Described insufficiently.

Edmondia marionensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 654. Chouteau limestone: Cooper county. Cannot be identified.

Grammysia blairi Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 93. Chouteau limestone: Sedalia. Probably identical with forms already described.

Isocardia curta Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 206. Coal Measures: Charboniere. Cannot be recognized.

Macrodon micronema Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 261. Kaskaskia limestone: Ste. Genevieve county. Cannot be recognized.

Pernopecten sedaliensis Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 93. Chouteau limestone: Sedalia. Too imperfect for recognition.

Solen missouriensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 655 Poorly defined.

CHAPTER XIII.

GASTEROPODS.

Dentalium primarium HALL.

Dentalium primarium Hall, 1858: Geology Iowa, vol. I, p. 666, pl. xxxiii, fig. 16.

Shell large, stout, nearly straight; surface smooth.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Warsaw (Illinois).

Dentalium missouriense SWALLOW.

Dentalium missouriense Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 99.

Shell rather large, thin, slightly curved, and marked with small longitudinal ribs.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Dentalium meekianum GEINITZ

Dentalium meekianum Geinitz, 1866: Carb. und Dyas in Nebraska, p. 13, t. i, fig. 20.

Dentalium meekianum Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 590, pl. xxix, figs. 8a-c.

Dentalium meekianum Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 234.

Dentalium meekianum Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 251.

Shell rather small, curved, subcylindrical, ornamented by numerous fine oblique lines.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

In the Carboniferous rocks of the Mississippi basin, four distinct types of Dentalium are recognized. The first has the surface ornamentation composed of a series of ridges trans-

verse to the axis of the shell, forming well-defined annulations, as in *D. annulostriatum* Meek & Worthen. The second has the costæ much less prominent, and arranged obliquely or spirally, as in the species under consideration. A third type has the ridges running longitudinally, as is rather imperfectly shown in *D. sublæve* Hall; and as is well seen in the type of the genus *D. elephantinum* Linnæus. The fourth variety has a perfectly smooth surface, as in *D. venustum* Meek & Worthen.

Pleurotomaria sedaliensis Miller.

Pleurotomaria sedaliensis Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 83, pl. xiv, fig. 13.

Horizon and localities.—Lower Carboniferous, Kinderhook limestone: Sedalia.

Pleurotomaria lens (Hall).

Euomphalus lens Hall, 1860: 13th Ann. Reg. Rep. Univ. New York, p. 109.

Straparollus lens Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 159, pl. xiv. figs. 7a–b.

Shell of medium size, lenticular, like *P. illinoiensis* in general shape, but with the spire slightly more elevated. Volutions about four in number, the last sharply rounded around the periphery; convex below.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Moniteau county.

Pleurotomaria montezuma Worthen

Pleurotomaria montezuma Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 324.

Pleurotomaria montezuma Worthen, 1891: Geol. Sur. Illinois, vol. VIII, p. 138, pl. xxiv, fig. 2.

Shell very large, turbinate; apical portions considerably elevated. Volutions about four in number, rapidly increasing in size toward the aperture; the upper ones strongly convex, the last more or less flattened above and below, forming a rather well-marked angularity around the periphery. Aperture obliquely ovate. Surface ornamented by prominent, revolving carinæ, of which seven or eight traverse the whorls above the

periphery, and from twelve to fifteen below; the spaces between the ridges are shallow and regularly concave from crest to crest; crossing these are numerous fine undulating lines of growth.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal.

Worthen's original description of this shell was based upon a very imperfect specimen, and was unaccompanied by illustrations of any kind; and it was not until more than eight years afterward that suitable figures of the form appeared. Were not the shell such a striking species, so different and so easily distinguished from all other forms of the genus, it would hardly be regarded as unjust to ignore altogether, the name given by Worthen.

Pleurotomaria subcarbonaria SP. NOV.

Plate xlix, fig. 2.

Shell small, closely resembling an immature specimen of *P. carbonaria.*

Horizon and localities.—Lower Carboniferous, Burlington limestone: Louisiana (Pike county); Kinderhook beds: Burlington (Iowa).

Pleurotomaria turbiniformis MEEK & WORTHEN.

Plate xlviii, figs 6a-b.

Pleurotomaria bicarinata McChesney, 1860: New Pal. Foss., p. 90. (Not Sowerby, 1818, nor de Koninck, 1843, nor Munster, 1844.)

Pleurotomaria turbiniformis Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 461.

Pleurotomaria turbiniformis Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 359, pl. xxviii, figs. 8a-c.

Pleurotomaria turbiniformis White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 160, pl. xxxii, figs. 7-8.

Shell rather above medium size, top-shaped, about as high as wide; spire occupying less than half the height; whorls five to six in number, sharply angular around the periphery, obliquely flattened above, slightly convex below, and curving gently into the small umbilicus; band very narrow; aperture obliquely subquadrate; surface marked by strong transverse

lines on the upper side of the whorls, crossed by about twenty longitudinal lines; band bordered on each side by a sharp ridge; lower half of whorls ornamented only by obscure revolving lines and lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Pleurotomaria subscalaris Meek & Worthen.

Pleurotomaria subscalaris Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 460.

Pleurotomaria subscalaris Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 360, pl. xxviii, figs. 10a-b.

Closely resembling *P. tabulata*, differing apparently chiefly in the absence of the crenulated periphery.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Meek & Worthen's type specimen was considerably waterworn or eroded, and consequently the apical parts and the sharp peripheral edge is rounded somewhat. The form may be, therefore, an old individual of *P. tabulata*, with the sharp outlines and crenulations obliterated.

Pleurotomaria missouriensis (Swallow).

Plate xlviii, fig. 8a-b.

Trochus missouriensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 657.

Pleurotomaria missouriensis Miller, 1877: Cat. Am. Pal. Foss., p. 159.

Shell very large, trochiform, with highly ornamented surface.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Pleurotomaria coxana Meek & Worthen.

Pleurotomaria coxana Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 272.

Pleurotomaria coxana Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 600, pl. xxviii, figs. 15a-b.

Shell very large, obliquely conical, much longer than wide; spire occupying over half the length. Whorls about seven in number, obtusely angular at the periphery, obliquely flattened

above, broadly rounded below; peripheral margin elevated above the suture, which is strongly defined; umbilicus small. Aperture large, subquadrate. Surface smooth, marked by small regular lines of growth.

Horizon and localities—Upper Carboniferous, Upper Coal Measures: Kansas City.

Pleurotomaria valvatiformis MEEK & WORTHEN.

Pleurotomaria valvatiformis Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 273.

Pleurotomaria valvatiformis Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 602, pl. xxix, figs. 9a-b.

Pleurotomaria valvatiformis Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 254.

Shell very small, about twice as wide as long. Whorls about four in number, rather rapidly increasing in size; very regularly convex; suture deep; umbilicus minute; aperture circular in outline, flattened somewhat on the inner side; surface marked by fine revolving lines.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

The form under consideration is the smallest of the group yet observed in the Mississippi basin. The species has a much wider geographic distribution than has hitherto been suspected, but owing to its small size has usually escaped observation. It has been reported from Macoupin county, Illinois, and from Polk county, Iowa.

Pleurotomaria speciosa MEEK & WORTHEN.

Pleurotomaria speciosa Meek & Worthen, 1860: Proc. Acad. Nat Sci., Phila., p. 459.

Pleurotomaria speciosa Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 352, pl. xxviii, figs. 5a-c.

Shell rather below medium size, conical, about as long as broad. Whorls about seven in number, the last as long as the spire, obliquely flattened above and angular toward the top; periphery sharp, convex below, with a very obtuse angularity passing around the middle; suture deep. Aperture subquadrate. Surface marked by filiform revolving lines, about

six of which occupy the area above the peripheral band, two or three the median flattened area, about twelve the under side; the peripheral band is also crenulated. These are crossed by fine lines parallel to the striations of growth, every fourth one of which is much stronger than the others.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Pleurotomaria coniformis Worthen.

Pleurotomaria conoides Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 217.

Pleurotomaria conoides Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 603, pl. xxviii, figs. 1a-c.

Pleurotomaria coniformis Worthen, 1882: Illinois St. Mus. Nat. Hist., Bul. 1, p. 38.

Shell quite small, conical, somewhat higher than wide. Whorls five in number, obliquely flattened parallel to the slope of the spire, the lower margins projecting a little beyond the upper edges of the succeeding volutions, angular at the periphery, flattened below, and rapidly curving toward the center into a small umbilicus. Aperture rhombic in outline; inner margin nearly straight and parallel to the axis of the shell below, abruptly turning outward at the base. Peripheral band rather narrow, bordered on each side by a small sharp ridge, which passes around thespire just above the suture. Surface marked on the upper half of the whorls by small, oblique, slightly curving lines, which on the lower side are less prominent, and resemble lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Pleurotomaria carbonaria Norwood & Pratten.

Pleurotomaria carbonaria Norwood & Pratten, 1855: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 75, pl. ix, fig. 8.

Pleurotomaria carbonaria Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 239.

Pleurotomaria carbonaria Keyes, 1891: Proc Acad. Nat. Sci., Phila., p. 253.

Pleurotomaria harii Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rept., pl. xiv, figs. 3-4.

Shell of medium size, subglobose; whorls five to six in number, regularly rounded. Aperture subcircular. Surface ornamented by twenty to thirty sharp, revolving carinæ, with broadly rounded, concave furrows between; these are crossed by fine, sharply defined lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

The original specimens of this species are from Williamson county, Illinois. A very similar form has been described from Newport, Indiana, under the name *P. newportensis.* Apparently the only difference ascribed is that it has the revolving band raised instead of depressed. Further comparisons may show, eventually, this character varietal rather than specific. This suggestion seems all the more plausible since many individuals which are unquestionably *P. carbonaria* have the band scarcely sunk below the general surface. The various examples of the species under discussion vary considerably in height; and Miller's recently described *P. harii* is merely one of the more depressed phases.

Pleurotomaria illinoisensis WORTHEN.

Pleurotomaria depressa Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 569, pl. viii, figs. 10-10a. (Not Passy, 1832.)

Pleurotomaria illinoisensis Worthen, 1884: Illinois St. Mus. Nat. Hist., Bul 2, p. 4.

Pleurotomaria modesta Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 238, pl. xii, figs. 2a-b.

Pleurotomaria kentuckensis Miller, 1890: N. A. Geol. and Pal., p. 421.

Pleurotomaria illinoisensis Worthen, 1891: Geol. Sur. Illinois, vol. VIII, p. 135, pl. xxiii, figs. 6-6b.

Pleurotomaria modesta Keyes, 1891: Proc Acad. Nat. Sci., Phila., p. 252.

Shell small, lenticular; spire greatly depressed; volutions about six in number, obliquely flattened above; body-whorl large, rapidly increasing in size, sharply angular on the periphery, flattened or even slightly concave above, broadly rounded below; suture very slightly impressed; peripheral band not well defined, and on the spire still more obscured by a single series of prominent nodes; aperture subquadrate; umbilcate region slightly impressed, but not perforated; surface glabrate, but showing fine lines of growth under a magnifying

glass. A series of small transverse folds or wrinkles is quite conspicuous toward the inner margin of the outer whorl; each fold appears to originate at a distinct node, and extends about one-half to two-thirds the distance to the periphery.

Horizon and localities.—Upper Carboniferous, Coal Measures: Clinton (Henry county), Knob Noster (Johnson county), Kansas City.

The species under consideration is widely distributed through the Lower Coal Measures of the continental interior, having been first recognized in 1857, by Cox, who figured it as *Pleurotomaria depressa.* This term had been used, however, previously. Nothing more was heard of the shell for more than thirty years, when it was found in the vicinity of Des Moines, Iowa, and renamed *P. modesta,* inasmuch as Cox's name had been pre-occupied. Two years later, Miller rechristened the form *Pleurotomaria kentuckyensis.* In the meanwhile Worthen reported a shell from Mercer county, Illinois, under the name of *P. illinoisensis,* giving at the same time a very meager description and no figures. Finally, in 1891 the eighth volume of the Illinois survey appeared, in which was given a figure of Worthen's shell, leaving but little doubt that it is identical with the form first noted by Cox.

Pleurotomaria perhumerosa MEEK.

Plate xlviii, fig 5.

Pleurotomaria perhumerosa Meek, 1872: U. S. Geol. Sur. Nebraska, p. 232. pl. iv, figs. 13a-b.

Shell of medium size; volutions four to six in number, expanding moderately from the apex; the body-whorl somewhat produced below; all the turns with a pronounced revolving angularity, above which is a rather broad, flattened area sloping outward and downward from the suture. Suture well marked. Aperture rather large, oval, with two angularities above. Surface glabrate, with fine lines of growth, and often a few low, rounded elevations running parallel to the angularity near the periphery.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Pleurotomaria sphærulata Conrad.

Pleurotomaria sphærulata Conrad, 1842: Jour. Acad. Nat. Sci, Phila., vol. VIII, p. 272, pl. xvi, fig. 12.

Pleurotomaria coronula Hall, 1852: Stanbury's Exped. Gt. Salt Lake, p. 413, pl. iv, figs. 4f, 6a–d.

Pleurotomaria sphærulata Hall, 1858: Geology Iowa, vol. I, p. 722, pl. xxix, fig. 13.

Pleurotomaria sphærulata White, 1884: Geol. Sur. Indiana, 13th. Ann. Rep, pt. ii, p. 161, pl. xxxii, figs. 152 and 153.

Pleurotomaria sphærulata Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 253.

Pleurotomaria sphærulata Keyes, 1891: Johns Hopkins Univ. Circulars, vol. XI, p. 29.

Shell of medium size, subturbinate; spire more or less depressed, with nearly straight sides; volutions about six in number, rather sharply rounded at the periphery; outer lip with a broad and deep notch. Surface glabrate, except along the suture, where there is a single row of rather conspicuous tubercles; a few indistinct lines of growth are also often discernible.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Pleurotomaria grayvillensis Norwood & Pratten.

Pleurotomaria grayvillensis Norwood and Pratten, 1855: Jour. Acad. Nat. Sci., Phila., vol. III, p. 75, pl. ix, fig. 7.

Pleurotomaria grayvillensis Geinitz, 1866: Carb. und Dyas in Nebraska, p. 9, tab. i, fig. 9.

Pleurotomaria grayvillensis Meek, 1872: U. S. Geol. Sur. Nebraska, p. 233, pl xi, fig. 9.

Pleurotomaria grayvillensis Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 238.

Shell rather small, conical, subovate, longer than wide; spire moderately elevated; volutions five to seven, obliquely flattened above. Body-whorl large, rapidly increasing in size, rounded below; biangular around the periphery, both angles being visible on the spire. Aperture subrhombic; outer margin sharp. Columella somewhat extended below. Surface ornamented by from 25 to 40 revolving lines, of which 20 or more occupy the inferior surface of the last turn; some of the

lines much more pronounced than others, and a more or less regular alternation of the more prominent ones with the secondary raised striæ; these are crossed by numerous regular lines of growth, giving a more or less tuberculate character, which is most conspicuous toward the suture.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Kansas City, Pleasant Hill (Cass county).

Pleurotomaria tabulata (CONRAD).

Turbo tabulata Conrad, 1835: Trans. Geol. Soc. Penn., vol. I, p. 267, pl. xii, fig. 1.

Pleurotomaria tabulata Conrad, 1842: Jour. Acad. Nat. Sci., Phila., vol. VIII, p. 272.

Pleurotomaria tabulata Hall, 1858: Geology Iowa, vol. I, p. 721, pl. xxix, figs. 12a-b.

Pleurotomaria tabulata White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 160, pl. xxxii, figs. 4, 5.

Shell rather above medium size, subconical, with the spire considerably elevated; volutions eight in number, sharply angular around the periphery, which is finely crenulated; from this prominent median carina, the outer surface is straight, or slightly concave, to the suture above and below; suture well defined; umbilicus closed; columellar lip but slightly thickened. Aperture subcircular, flattened posteriorly, and quite angular on each side; outer lip distinctly notched. Surface ornamented by numerous fine, revolving, very narrow ridges; these are crossed by lines of growth, which abruptly bend at the peripheral angle.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Pleurotomaria brazoensis SHUMARD.

Plate xlviii, figs. 2a-b.

Pleurotomaria brazoensis Shumard, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 624.

Pleurotomaria brazoensis Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 354, pl. xxviii, figs. 1a-d.

Pleurotomaria brazoensis Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 237.

Shell rather small, trochiform; spire occupying about one-half the entire length. Whorls six in number, obliquely flat-

tened above; very slightly convex below, with a prominent bicarinate peripheral prominence. On the apical portions only the upper of the two carinæ is elevated above the sutural line, near which is a thickened, subangular, more or less obscurely nodose ridge. Aperture somewhat rhombic in shape. Surface marked by a score or more of minute, filiform, revolving lines, of which twelve to fourteen are anterior to the peripheral edge; these are crossed by small transverse costæ.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Clinton (Henry county).

The specimens examined do not present much variation. The two peripheral carinæ are nearly equal, and between them is located the concave band of the sinus. The whorls are ornamented by sixteen or seventeen straight, filiform lines, nine below the lower carina, upon which there are two thread-like elevations; three above the upper carina, upon which there are two or three lines, and a single line on the sinal band. Crossing the small revolving ridges are numerous well-marked equidistant transverse lines, which give to the whole ornamentation a characteristic cancellated appearance. Between, and parallel to, these transverse raised striæ are also from three to six microscopic, yet sharp and distinct raised striæ.

Meek and Worthen refer, with a query, to Shumard's species, a form from Macoupin county, Illinois, having about twenty-five revolving lines (twelve of which occupy the lower side of the body-whorl), instead of thirteen or fourteen, as ascribed by Shumard to this species. Shumard says: "Surface of volutions ornamented with from thirteen to fourteen rather strong filiform striæ, which are crossed by sharp transverse striæ." If by this he intends to convey the idea that this is the entire number of lines, including those on the under side of the body-whorl, Meek and Worthen remark that they "should scarcely entertain a doubt in regard to our [their] shell being a distinct species, since it uniformly has about double that number of revolving striæ on the last whorl."

Pleurotomaria monilifera (WHITE).

Naticopsis monilifera White, 1883: U. S. Geol. and Geog. Sur. Ter., Twelfth Ann. Rep., p. 168, pl. xlii, figs. 3a–c.

Shell rather below medium in size, subglobose; spire short, blunt; whorls five to six in number, the last very large; last two volutions with a prominent row of rounded tubercles along the sutural lines; surface otherwise smooth and polished. Aperture subovate; inner lip callous; outer one thin, with a somewhat bending margin.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Pleasant Hill, Kansas City.

It is quite manifest, after an examination of the type specimen, that the shell described by White as *Naticopsis monilifera* does not properly belong to *Naticopsis* as now understood. And although the peripheral band has not as yet been made out with absolute certainty, it seems very probable that this form actually is a member of one of the sections of *Pleurotomaria*, along with *P. sphærulata* and others.

Pleurotomaria broadheadi WHITE.

Plate xlviii, figs. 1a-b.

Pleurotomaria broadheadi White, 1883: U. S. Geol. and Geog. Sur.. Ter. Twelfth Ann. Rep., p. 169, pl. xlii, figs 1a-b.

Shell large, sub-globose; spire elevated, occupying nearly half the length; volutions six or seven, the last comparatively large; peripheral band quite narrow and obscure. Aperture somewhat ovate, slightly angular anteriorly: inner lip thin; outer labrum curved. Surface ornamented by 35 to 40 depressed revolving lines.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City, Clinton (Henry county).

Murchisonia melaniaformis Shumard.

Plate xlix, fig. 8.

Murchisonia melaniaformis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 208, pl. C, fig. 13.

Shell rather small, slender, composed of about ten whorls, which are gently convex; suture moderately impressed. Aperture subovate, slightly angular behind, surface smooth.

Horizon and localities — Cambrian limestone: Moselle (Franklin county).

Murchisonia major Hall.

Plate xlix, figs. 5a-b.

Murchisonia major Hall, 1851: Geol. Lake Superior Dist., vol. II, p. 209, pl. xxvi, fig 1.

Murchisonia bellicincta Owen, 1852: Geol. Sur. Wisconsin, Iowa and Minnesota, tab. ii, fig. 8. (Not Hall, 1847.)

Murchisonia major Whitfield, 1882: Geol. Sur. Wisconsin, vol. IV, p. 244, pl. ix, fig. 4.

Shell large, robust, terete; volutions eight to ten in number, strongly convex, with the suture deeply impressed. Aperture subovate. Surface smooth in Missouri specimens.

Horizon and localities.—Lower Silurian, Trenton limestone: McCune (Pike county).

While there is no doubt as to the identity of this form as found in Missouri, and the shells long ago found by Owen in northeastern Iowa, it is not at all likely that any of these specimens are the same which Hall described from New York under the name of *M. bellicincta.*

Murchisonia carinifera Shumard.

Murchisonia bicincta Hall, 1847: Pal. New York, vol. I, p. 177, pl. xxxviii, figs. 5a-b. (Not McCoy, 1841.)

Murchisonia carinifera Shumard, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 106.

Murchisonia milleri Hall, 1877: Miller's Pal. Foss., p. 244.

Shell of medium size, somewhat conical, spire rather short; volutions four to six in number, with a prominent median carina, below which is a second more or less obscure angularity; above and below the peripheral elevation the whorls are con-

siderably flattened; suture rather deeply impressed; aperture subcircular, and somewhat angular in front.

Horizon and localities.—Lower Silurian, Trenton limestone: Glencoe (St. Louis county).

This shell, usually found through the continental interior, occurs as natural internal casts. In both the shell and the cast the secondary revolving angularity, a short distance below the periphery, is frequently not apparent; in other individuals it is barely noticeable, but in the majority of specimens it is more or less well marked.

There is scarcely any hesitancy in referring Hall's forms and the specimens described by Shumard as *M. carinifera* to one and the same species. Unfortunately Hall's name was preoccupied by McCoy, in 1844, and it becomes necessary to adopt Shumard's term for this shell, though Hall, in 1877, rechristened the species. The specimens used by Shumard in his description were, in all probability, natural casts; yet the Missouri localities also furnish well-preserved shells, showing all the structural characters.

Murchisonia gracilis Hall.

Murchisonia gracilis Hall, 1847: Pal. New York, vol. I, p. 180, pl. xxxix, figs. 4a-c.

Shell small, very slender, with evenly rounded whorls. Surface smooth, showing only the peripheral band and fine lines of growth.

Horizon and localities.—Silurian, Trenton limestone: McCune station (Pike county).

Murchisonia terebra White.

Plate xlix, fig. 4.

Murchisonia terebra White, 1883: U. S. Geol. Sur. Terr., 12th Ann. Rep., p. 139, pl. xxxiv, fig. 4.

Shell very long and slender; whorls numerous, angulated around the periphery.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Bellerophon bilobatus ? Sowerby.

Plate II, fig. 2.

Bellerophon bilobatus Sowerby, 1839: Murchison's Sil. Syst., p. 643.
Bellerophon bilobatus Hall, 1847: Pal. New York, vol. I, p. 184.

Shell of medium size, rather rapidly expanding to the aperture.

Horizon and localities.—Lower Silurian, Trenton limestone: Glencoe (St. Louis county).

Bellerophon panneus White.

Plate I, fig. 6.

Bellerophon panneus White, 1862: Proc. Boston Soc. Nat. Hist , vol. IX, p. 21.
Bellerophon panneus Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 297.

Shell globose, composed of about four volutions, all of which are visible in the rather small, very deep umbilici; periphery somewhat flattened, with a very prominent longitudinal carina; the surface marked by sharp, equidistant costæ passing transversely across the whorls from the large median ridge; transverse elevations somewhat undulating and irregular, and bending forward slightly as they leave the central prominence; finer lines of growth are also visible between the costæ.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Burlington (Iowa); apparently fragments also of this species from Hannibal.

Bellerophon bilabiatus White & Whitfield.

Plate I, fig. 3.

Bellerophon bilabiatus White & Whitfield, 1862: Proc. Boston Soc. Nat. Hist., vol. VIII, p. 304.
Bellerophon bilabiatus Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 297.

The deeply and broadly emarginate lip, the nearly glabrate surface and a sharp, narrow, median carina readily distinguish this form from the associated species of the genus.

Horizon and localities.—Lower Carboniferous, Kinderhook group: Chouteau Springs; Burlington limestone: Louisiana.

Bellerophon sublævis Hall.

Bellerophon sublævis Hall, 1856: Trans. Albany Inst., vol. IV, p. 32.
Bellerophon sublævis Hall, 1858: Geology Iowa, vol. I, p. 666, pl. xxiii, figs. 15a–c.
Bellerophon sublævis Whitfield, 1882: Bul. Am. Mus. Nat. Hist., vol. I, p. 89, pl. viii, figs. 6–7.
Bellerophon sublævis Hall, 1883: Geol. Sur. Indiana, Ann. Rep., p. 371, pl. xxxi, figs. 6–7.
Bellerophon sublævis White, 1882: Geol. Sur. Indiana, 11th Ann. Rep., p. 359, pl. xl, figs. 5–7.

Shell rather small, globose, gradually and regularly expanding to the aperture; umbilicus closed. Aperture transversely reniform, sinus moderately deep; outer lip thin toward the middle, greatly thickened at the sides; inner lip but slightly developed. Surface marked only by fine, even lines of growth.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Bellerophon bellus sp. nov.

Plate I, fig. 7.

Shell subglobose, expanding rapidly at the aperture, which is somewhat reniform, with the lip reflected at the sides. Surface marked by a rather prominent, longitudinal carina along the median portion of the shell; strong transverse ridges parallel to the lines of growth pass from one umbilical region to the other; these are crossed by less prominent longitudinal lines, the two sets forming a beautiful cancellated area.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Bellerophon marcouanus Geinitz.

Plate II, fig. 3.

Bellerophon marcouanus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 7, tab. I, fig. 12.
Bellerophon marcouanus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 226, pl. iv, fig. 17; and pl. xi, figs. 13a–b.

Shell much like *B. montfortianus*, with broadly expanded aperture; but the numerous filiform, longitudinal ridges are

not interrupted by transverse elevations or nodes, and the fine lines are very uniform in size.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Bellerophon meekianus Swallow.

Bellerophon meekianus Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 204.

Shell rather small, broadly rounded on the dorsum, with a well-defined angularity toward the aperture; the latter transversely reniform; outer lip thin medially, much thickened toward the umbilical axis on either side, and more or less reflected. Surface marked by numerous crowded filiform lines; those running longitudinally the more prominent.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Lexington, and in Howard county.

Bellerophon urii Fleming.

Plate 1, figs. 5a–c.

Bellerophon urii Fleming, 1828: Brit. Anim., p. 338.

Bellerophon urii de Koninck, 1844: Descriptions des Animaux Fossiles (de Belgique), p. 356, pl. xxx, fig. 4.

Bellerophon urii Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., vol. III, p. 75, pl. ix, fig. 6.

Bellerophon carbonarius Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 562.

Bellerophon blaneyanus McChesney, 1860: New Palæ. Foss., p. 60.

Bellerophon carbonarius Geinitz, 1866: Carb. und Dyas in Nebraska, p. 6, tab. i, fig. 8.

Bellerophon carbonarius Meek, 1872: U. S. Geol. Sur. Nebraska, p. 224, pl. iv, fig. 16; and pl. xi, figs. 11a–c.

Bellerophon carbonarius, var. *subpapillosus* White, 1876: Geol. Uinta Mts., p. 92.

Bellerophon subpapillosus White, 1879: Bul. U. S. Geol. Sur. Terr., vol., V, p. 218.

Bellerophon subpapillosus White, 1883: U. S. Geol. Sur. Terr., 12th Ann. Rep., p. 38, pl. xxxiv, fig. 3a.

Bellerophon carbonarius White, 1884: Geol. and Nat. Hist. Sur. Indiana, 13th Ann. Rep., p. 158, pl. xxxiii, figs. 6, 7, 8.

Bellerophon urii Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 236.

Bellerophon urii Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 255.

Bellerophon urii Keyes, 1891: Johns Hopkins Univ. Circulars, vol. XI, p. 29.

Shell of medium size, globose, dorsum broadly rounded; umbilici closed; aperture transversely semilunate, but not expanding much more rapidly than the uniform enlargement of the volutions; inner lip but slightly developed; outer lip thickened and rounded toward the umbilici, but becoming very attenuated medially; its central sinus rather broad, rounded and not very deep. Medial band obscure on the costate portion of the shell, but on the terminal half of the body whorl more or less distinct, and in some specimens bordered on each side by a low, narrow, yet well-defined ridge. Surface, except the last half of the outer whorl, ornamented with from 16 to 30 or more sharp, simple, nearly parallel costæ; terminal half of the body whorl generally glabrate, except along the medial portion, which is often marked by lines of growth, and sometimes by two longitudinal angularities. Often the greater part of the smooth area is covered with small but well-defined tubercles.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

The form considered here under the name of *Bellerophon urii* is the one usually designated by American palæontologists as *B. carbonarius*. A careful comparison of the descriptions and figures of the various writers on this group of Gasteropods, and of a large series of specimens fails to furnish any valid reasons for separating specifically the American form from the European shell described by Fleming in 1828 as *Bellerophon urii*. Norwood and Pratten correctly referred the specimens collected by Cox in Kentucky to *B. urii;* but Cox in 1857 made them the types of a species which he called *B. carbonarius*, distinguishing it from the European form by the slight lateral expansion of the mouth, and particularly by the less number of revolving costæ, which in *B. carbonarius* were said to vary from nineteen to twenty-five, while, according to de Koninck, *B. urii* had from thirty-six to thirty-eight. Though de Koninck does make this latter statement in his earlier work, his later Recherches state that the number varies from twenty-two to thirty. McChesney, in the description of his *B. blaneyanus*, seems also to have made the chief distinctive character

between his species and the European representative, the possession by the former of only sixteen ribs, or about half the number ascribed to *B. urii* by de Koninck.

Bellerophon crassus MEEK & WORTHEN.

Plate I, figs. 1a-b.

Bellerophon crassus Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 458.

Bellerophon crassus Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 385, pl. xxxi, figs. 16a-16b.

Bellerophon crassus White, 1875: Expl and Sur. w. 100 merid., vol. IV, p. 157, pl. xii, fig. 1a.

Bellerophon crassus White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., p. 157, pl. xxxiii, figs. 1-2.

Shell very large, massive, subglobose, whorls rather rapidly increasing in size; umbilicus depressed, but not perforated; medial band narrow, well defined and bordered on each side by a well-marked ridge. Aperture transversely reniform, or sublunate; outer lip greatly thickened toward the umbilical region, much thinner centrally on each side of the rather narrow sinus; callosity of the inner labrum thick. Surface unmarked except by lines of growth and irregular wrinkles.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City, Lexington.

Bellerophon montfortianus NORWOOD & PRATTEN.

Bellerophon montfortianus Norwood & Pratten, 1855: Jour. Acad. Nat. Sci., Phila, (2), vol. III, p. 74, pl. ix, fig. 5.

Bellerophon montfortianus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 8, tab. i, fig. 13.

Bellerophon interlineatus Geinitz, 1866: Carb. und Dyas in Nebraska, p. 9, tab. i, fig. 14. (Not Portlock, 1843.)

Bellerophon montfortianus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 225, pl. ix, fig. 15.

Bellerophon montfortianus White, 1876: Geol. Uinta Mts., p. 92.

Bellerophon montfortianus White, 1882: U. S. Geog. Sur. w. 100 Merid., Supp. vol. III, app, pp xi, xv and xviii.

Bellerophon montfortianus Keyes, 1888: Proc. Acad. Nat. Sci, Phila, p. 235.

Bellerophon montfortianus Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 235.

Bellerophon montfortianus Keyes, 1891: Johns Hopkins Univ. Cir., vol. XI, p. 29.

Shell with inner whorls small, outer one broadly expanded; band narrow, well defined and slightly elevated in the center of a rather deep, longitudinal depression; umbilicus closed. Aperture ample, transversely reniform; outer lip very thin medially, but becoming greatly thickened toward the umbilical parts; sinus moderately deep; inner labrum callous. Surface marked by fine raised longitudinal lines, about every fourth one of which is much more prominent than the others; these are crossed by many minute striations parallel to the lines of growth. With the exception of the expanded portion of the shell, the volutions are also ornamented by large nodose ridges extending from the median depression to the umbilicus on each side.

Horizon and localities.— Upper Carboniferous, Upper Coal Measures: Kansas City.

Bellerophon stevensianus McChesney.

Bellerophon stevensianus McChesney, 1860: Desc. New Pal. Foss., p. 61.
Bellerophon stevensianus McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 46, pl. ii, fig. 18.

Shell small, somewhat compressed, gradually expanding; band rather narrow, forming a prominent medial ridge, which is bordered on each side by a slight depression; aperture somewhat semilunate; outer lip thin, much thickened toward the umbilical regions. Surface marked by prominent lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Bellerophon nodocarinatus Hall.

Plate 1, figs. 4a–c.

Bellerophon nodocarinatus Hall, 1858: Geology Iowa, vol I, p. 725, pl. xxix, figs. 15a-c.
Bellerophon tricarinatus Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 204.
Bellerophon inspeciosus White, 1882: U. S. Geog. Sur. w. 100 Merid., Supp. vol. III, App., p. xxx, pl. iv, figs. 1a–c.
Bellerophon nodocarinatus White, 1884: Geol. Sur. Indiana, 13th Ann. Rep. p. 159. pl. xxxviii, figs. 3-5.

Shell rather large, heavy, subglobose, only slightly expanded toward the aperture; volutions regularly rounded, the last with three low, broad, longitudinal folds, which are often more or less nodose. Surface, excepting the last half of the body whorl, marked by narrow, rather well-defined longitudinal ridges.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Bellerophon percarinatus Conrad.

Plate I, figs. 2a-f.

Bellerophon percarinatus Conrad, 1842: Jour. Acad. Nat. Sci., Phila., vol. VIII, p. 268, pl. xvi, fig. 5.

Bellerophon percarinatus Norwood and Pratten, 1855: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 74, pl. ix, fig. 4.

Bellerophon percarinatus Meek, 1872: U. S. Geol. Sur. Nebraska, p. 227, pl. iv, figs. 15a-b.

Bellerophon percarinatus White, 1884: Geol. Sur. Indiana, 13th. Ann. Rep , pt. ii, p. 158, pl. xxxiii, figs. 9-14.

Bellerophon percarinatus Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 234.

Bellerophon percarinatus Keyes, 1891: Johns Hopkins Univ. Circulars, vol. XI, p. 29.

Shell of medium size, subglobose, broadly expanded toward the aperture; umbilicus closed; outer lip thin medially, much thickened at the sides; callous portions of the inner labrum quite thick. Last whorl marked by large transverse folds or wrinkles, each of which has a prominent nodosity in the middle, the entire series resembling a prominent median ridge. On each side of the central nodose elevation is another series of more or less conspicuous nodes, giving to the shell a distinct tricarinate aspect. The surface is otherwise ornamented only by lines of growth, which not unfrequently are somewhat imbricated.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Porcellia nodosa HALL.

Plate ii, fig. 4.

Porcellia nodosa Hall, 1860: Geology Iowa, vol. I, Supp., p. 4.
Porcellia nodosa Meek & Worthen, 1868: Geo'. Sur. Illinois, vol. III, p. 458, pl. xiv, figs. 1a-b.

Shell large, thin. Whorls about four in number, closely united, circular in cross-section, with a dozen or more large nodes on each side of the median plane; dorsal cleft narrow, deep. Surface marked by fine, regular transverse lines, which are crossed by less prominent longitudinal ones.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Louisiana (Pike county).

Cyclomena bilix (CONRAD).

Pleurotomaria bilix Conrad, 1842: Jour. Acad. Nat. Sci., Phila, vol. VIII, p. 271, pl. xvi, fig. 10.
Pleurotomaria? bilix Hall, 1847: Pal. New York, vol. I, p. 305, pl. lxxxiii, figs. 4a-e.
Cyclonema bilix Hall, 1852: New York State Cab. Nat. Hist., 12th Ann. Rep., p. 74.
Cyclonema bilix Meek, 1873: Geol. Sur. Ohio, Pal., vol. I, p. 151, pl. xiii, figs. 5a, c, d, g.
Cyclonema bilix White, 1881: Geol. Sur. Indiana, 10th Ann. Rept, p. 492, pl. ii, figs. 3-4.

Shell variable in form, subglobose to subconoid. Volutions about five in number, increasing rapidly in size, moderately convex, with a decided tendency to flattening on the upper side, parallel to the general slope of the spire—the last volution being rather sharply rounded; suture well defined. Aperture broadly oval or subquadrate; inner lip thickened; outer lip thin, short. Surface marked by revolving lines, which are crossed by oblique lines parallel to the lines of growth.

Horizon and localities—Lower Silurian, Trenton limetone: McCune (Pike county).

Anomphalus rotulus MEEK & WORTHEN.

Anomphalus rotulus Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 263.
Anomphalus rotulus Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 597, pl. xxix, figs. 10a-c.
Anomphalus rotulus Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 241.

Shell very small, depressed, spire scarcely elevated above body whorl; volutions about four in number, moderately convex above and below, but sharply rounded at the periphery, slightly turned inward in the umbilical region; suture linear, not impressed; aperture transversely suboval, somewhat flattened on the inner side below. Surface glabrate.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Clinton (Henry county).

Trochonema umbilicata (Hall).

Pleurotomaria umbilicata Hall, 1847: Pal. New York, vol. I, p. 43.
Trochonema umbilicata Salter, 1859: Canadian Org. Remains, Dec. VII, p. 27.
Trochonema umbilicata Hall, 1862: Geol. Sur. Wisconsin, p. 440.
Trochonema umbilicata Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 314, pl. iii, figs. 5a-b.

Shell subconical, wider than high; whorls about three in number, with four revolving annulations; aperture obovate. Surface smooth, or with lines of growth moderately prominent.

Horizon and localities.—Lower Silurian, Trenton limestone: Pike county.

Genus Straparollus Montfort.

The generic relations of Stráparollus and Euomphalus have long been a subject of controversy. And, while the question cannot at present be regarded as definitely settled, the evidence derived from all available sources points to the co extension of the two genera. The two terms are of common occurrence in the literature of American Palæontology, and have been applied indifferently both to planorbiform gasteropod shells having angulated whorls, and those possessing rounded volutions. The latter features were originally regarded as distinctive. Yet the multiplicity of forms manifestly belonging to the group founded by Montfort, has given rise to the establishment of a number of genera which can now be considered only as of little or no utility, and seem best disposed of when placed in the synonymy of this genus. Aside from the two leading sections, however, these various terms require no further reference here. Each name was primarily proposed for a

group seemingly quite distinct. But later inquiry has indicated that the alleged generic distinctions are actually more apparent than real; and that the two sections can, with great propriety, be considered under a single term. Some recent writers have even proposed to make the two genera in question identical with Solarium, established by Lamarck for a group of modern gasteropods. But it does not appear feasible, nor advisable, to extend the limits of the Lamarckian genus, as they suggested; while practically the separation of the recent and ancient forms is not difficult, and, as a matter of fact, is very convenient to the systematist.

Straparollus, as defined by Montfort, has for its type *S. dionysii* Mont.—a form with the spire somewhat elevated, the umbilicus broad and shallow, and the whorls regularly rounded. Euomphalus of Sowerby, represented by *E. pentangularis* Sow., includes planorbiform shells, having more or less distinctly angulated volutions. With the types alone under consideration, the two groups might appear sufficiently well marked to warrant their generic separation. A more extended comparison, however, of the described species reveals no reliable criteria by which the two groups may be distinguished. A further consideration of these resemblances and differences of divers individuals shows that they are so variable, and that the gradations are so complete, that the generic limitations heretofore usually assigned are clearly untenable.

Briefly stated, the general characters of Straparollus are: Shell rather thick, planorbiform, or depressed conical, broadly and often deeply umbilicated; whorls angular or rounded, usually closely coiled, but often barely in contact; aperture sharply pentagonal to sub-circular; labrum generally sharp. The surface of the volutions is for the most part smooth, or showing only numerous lines of growth; but sometimes with one or more distinct longitudinal carinæ.

In the majority of cases the carinæ or angular prominences on the whorls of certain Straparolli appear to be simply thickenings of the shell at those points. The internal transverse section is circular, as shown when the shell is removed from

the matrix forming the cast of the inside. Some species have a thickened shell, with the whorls barely in contact, or even separated toward the aperture. In instances of this kind the internal casts have much the appearance of some of the forms for which Sowerby established the genus Phanerotinus. But with the latter have evidently been included a number of evolute Straparolli.

Straparollus valvataformis Shumard.

Plate 11, fig. 8.

Straparollus valvataformis Shumard, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 105.

Shell small, closely resembling *S. spergenensis*.

Horizon and localities. — Cambrian limestone: Ozark county.

Straparollus obtusus (Hall).

Plate 11, fig. 5.

Euomphalus obtusus Hall, 1858: Geology Iowa. vol. I, p. 523.
Straparollus obtusus Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 296.
Straparollus obtusus Keyes, 1890: American Geologist, vol. V, p. 197, pl. 1, figs. 2a–c.

Shell large, planorbiform, composed of five to six regularly rounded volutions; spire on a level with, or slightly below, the upper surface of the last whorl; suture very deeply impressed; upper surface of the volutions very slightly flattened on the inner side near the suture; umbilical region very broad and shallow; aperture circular.

Horizon and localities. — Lower Carboniferous, Lower Burlington limestone: Louisiana (Pike county), Hannibal.

This form was the first of the group recognized in the Kinderhook rocks along the Mississippi river, and is one of the most characteristic gasteropods of this horizon at Burlington (Iowa), and elsewhere. At the latter place it occurs in the oolitic layer a few feet below the Burlington limestone, and is easily distinguished from all the congeneric species of the locality by its large size—often attaining a diametric measurement of more than six centimeters—its greatly depressed spire,

broad, shallow umbilicus and regularly rounded whorls. In many examples of this species the volutions are barely in contact with one another, and in a few instances the outer whorl, toward the aperture, has actually become separated from the adjoining inner turns. This fact is of special interest as illustrating the first noticeable departure toward certain evolute Straparolli, which have been referred to Phanerotinus of Sowerby.

Straparollus ammon (White & Whitfield).

Plate ii, fig. 6.

Euomphalus ammon White & Whitfield, 1862: Proc. Boston Soc. Nat. Hist., vol. VIII, p. 307.

Straparollus ammon Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 295.

Shell small, with rounded whorls, spiral portions raised but little above the plane of the body volution. Surface smooth, with numerous fine lines of growth.

Horizon and localities.—Lower Carboniferous, Lower Burlington limestone: Lousiana (Pike county).

Straparollus latus (Hall).

Plate ii, fig. 9.

Euomphalus latus Hall, 1858: Geology Iowa, vol. I, p. 605, pl. xxii, figs. 7a-b.

Euomphalus boonensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 99.

Straparollus latus Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 292.

Straparollus latus Keyes, 1890: Am. Geologist, vol. V, p. 196, pl. vii, figs. 1a-b.

Straparollus blairi Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 86, pl. xv, fig. 3.

Shell rather large, discoid, composed of four to five rather rapidly enlarging volutions, plane above; spire nearly on a level with the upper surface of the outer whorl; suture impressed; deeply and broadly umbilicate; aperture nearly circular, flattened above. The broad flattened area occupying the upper surface of the volutions is bordered on each side by a distinct carina, the inner being near the sutural line. Below the outer ridge are sometimes two scarcely perceptible angularities, one around the periphery and the other along the mid-

dle of the whorls below. The latter, as shown in young specimens, is often well defined, but after the shell has become half grown, the obtuse prominence becomes obscured. In some specimens the ridge above the periphery is so pronounced as to leave a narrow concave area immediately beneath.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Springfield (Greene county), Ash Grove (Greene county), Osceola (St. Clair county), Louisiana, Hannibal.

Straparollus latus is the most characteristic form of the genus occurring in the Burlington, but it is not very common. It attains a maximum diameter of eight centimeters.

Straparollus spergenensis (Hall).

Euomphalus spergenensis Hall, 1858: Trans. Albany Inst., vol. IV, p. 19.
Euomphalus spergenensis, var. *planorbiformis* Hall, 1858: Trans. Albany Inst., vol. IV, p. 20.
Straparollus spergenensis Miller, 1877: Cat. Am. Pal. Foss, p. 163.
Straparollus spergenensis var. *planorbiformis* Miller, 1877: Cat. Am. Pal. Foss., p. 163.
Euomphalus spergenensis Whitfield, 1882: Bul. Am. Mus. Nat. Hist., vol. I, p. 69, pl. viii, figs. 16-19.
Euomphalus spergenensis, var. *planorbiformis* Whitfield, 1882: Bul. Am. Mus. Nat. Hist., vol. I, p. 70, pl. viii, figs. 20-21.
Euomphalus spergenensis Hall, 1883: Geol. Sur. Indiana, 12th Ann. Rept., p. 350, pl. xxxi, figs. 16-19.
Euomphalus spergenensis, var. *planorbiformis* Hall, 1883: Geol. Sur. Indiana, 12th Ann. Rept., p. 351, pl. xxxi, figs. 20 22.

Shell small, depressed conical, composed of four to six rounded volutions, which are more or less flattened above, near the suture; broadly umbilicated; suture well defined. Aperture oblique, circular; lip sharp. Surface marked only by numerous, closely arranged, fine lines of growth.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Considerable variation in shape is observable among the shells of this species. Many show quite a marked flattening of the apical portions, while others have the spire more or less elevated, and in this respect closely simulating the type of the genus *S. dionysii* Montfort.

Straparollus planidorsatus Meek & Worthen.

Euomphalus planidorsatus Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 462.

Euomphalus perspectivus Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 98.

Straparollus planidorsatus Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 302, pl. xxiv, figs. 2a-c.

Shell rather below medium size, planorbiform; spire a little elevated; whorls four or five in number, flattened above, with a well-defined angularity toward the peripheral margin; regularly rounded below, though often a slight revolving prominence is also discernible; suture rather deeply impressed; umbilicus broad and rather deep; aperture nearly circular; surface smooth, with occasional lines of growth.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Straparollus catilloides (Conrad).

Inachus catilloides Conrad, 1842: Jour. Acad. Nat. Sci., Phila., vol. VIII, p. 273, pl. xv, fig. 3.

Euomphalus rugosus Hall, 1858: Geology Iowa, vol. I, p. 723, pl. xxix, fig. 14. (Not Sowerby, 1812.)

Serpula (*Spiorbis*) *planorbites* Geinitz, 1866: Carb. und Dyas in Nebraska, p. 3, tab. i, fig. 6. (Not Munster.)

Straparollus (*Euomphalus*) *rugosus* Meek, 1872: U. S. Geol. Sur. Nebraska, p. 230, pl. vi, figs. 5-6; and pl. xi, figs. 4a-b.

Straparollus (*Euomphalus*) *subrugosus* Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 607, pl. xxix, fig. 11.

Euomphalus rugosus White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., p. 161, pl. xxxii, figs. 11-12.

Euomphalus rugosus Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 241.

Straparollus catilloides Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 253.

Straparollus catilloides Keyes, 1891: Johns Hopkins Univ. Circulars, vol. XI, p. 29.

Shell small, planorbiform, concave above and below; whorls five in number, increasing gradually in size, obliquely flattened on the periphery, which is bordered on each side by a narrow rounded ridge, and on the upper and lower sides. Aperture trapeziform outside, circular inside. Surface smooth, but often strongly marked by lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Atchison, Kansas City.

There appears to be but little doubt that the form described by Conrad from the region east of the Appalachians as *Inachus catilloides*, and *Euomphalus rugosus* of Hall, are identical. Although Conrad's original description is brief, his figure shows clearly the kind of a shell he had under consideration. A careful comparison of a large series of Pennsylvania specimens and those forms from the Mississippi basin, fails to bring out any differences sufficiently marked to warrant a specific separation of the shells of the two districts. The form is generally known throughout the continental interior under Hall's name. That designation, however, was preoccupied by Sowerby in 1812, and for this reason Meek and Worthen proposed *subrugosus* for the specific title. After all, it is very probable that the form should more properly be regarded as identical with a certain European species; and further comparison may require the mergence of the two species now regarded as valid. *S. catilloides*, as now understood, is widely distributed geographically, and is one of the most abundant and characteristic shells of the Coal Measures of the Mississippi basin. It often attains a very considerable size, though, as a rule, its maximum measurement is not greater than ten or twelve millimeters.

Straparollus pernodosus MEEK & WORTHEN.

Straparollus pernodosus Meek & Worthen, 1870: Proc. Acad. Nat. Sci., Phila., p. 45.
Straparollus pernodosus Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 604, pl. xxix, figs. 14a-c.
Euomphalus pernodosus Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 241.
Straparollus pernodosus Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 286.

Shell rather large, planorbiform, with the spire on a level with the upper edge of the body-whorl; volutions five or six in number, flattened above, rounded below, with a well-defined row of large nodes disappearing toward the aperture; the upper peripheral margin has a prominent carina, from which the surface slopes inward to the suture; umbilicus broad, moderately deep, showing all the inner whorls. Surface marked by con-

spicuous, often imbricated lines of growth and frequently also by broad, transverse wrinkles.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Kansas City.

Straparollus subquadratus MEEK & WORTHEN.

Straparollus subquadratus Meek & Worthen, 1870: Proc. Acad. Nat. Sci., Phila., p. 46.

Straparollus subquadratus Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 605, pl. xxix, figs. 12a-c and 13a-c.

Shell similar to *S. catilloides*, but very much larger, with the nodes and transverse wrinkles very much more pronounced.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Kansas City.

Omphalotrochus springvalensis (WHITE).

Plate ii, fig. 7.

Euomphalus springvalensis White, 1876: Proc. Acad. Nat. Sci., Phila., p. 32.

Euomphalus springvalensis White, 1883: U. S. Geol. and Geog. Sur. Terr., 12th Ann. Rep., p. 167, pl. xii, figs. 1a-b.

Straparollus springvalensis Keyes, 1890: American Geologist, vol. V, p. 195.

Shell large, conical, about as high as wide. Whorls about six in number, flattened slightly above, regularly rounded below. Aperture sub-circular in outline. Surface smooth.

Horizon and localities.—Lower Carboniferous, Lower Burlington limestone: Louisiana (Pike county).

Ophileta compacta SALTER.

Ophileta compacta Salter, 1859: Canadian Org. Rem., Decade 1, p. 16, pl. iii, figs. 1-3.

Shell discoid, composed of six or more volutions, obliquely flattened above. Surface marked by oblique, sigmoid lines.

Horizon and localities—Cambrian limestone: Washington county.

Raphistoma subplana SHUMARD.

Raphistoma subplana Shumard, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 106.

Shell depressed, turbinate; width rather more than one-third the height; whorls about four, periphery of last one sharply angular, inner edge obtusely angulated; upper surface subplane, with a shallow groove just within the exterior margin; under surface convex; umbilicus small; aperture transverse, subtrigonal. Width 4¾ lines, height 3 lines. (Shumard.)

Horizon and localities. — Cambrian limestone: Ozark county.

Raphistoma lenticularis (CONRAD).

Pleurotomaria lenticularis Conrad, 1842: Emmon's Geol. Rep. New York, p. 392, fig. 2, and p. 293, figs. 2, 3.
Pleurotomaria lenticularis Owen, 1844: Geol. Expl. Iowa, Wisc. and Ill., p. 86, pl. xviii, fig. 6.
Raphistoma lenticularis Salter, 1859: Canadian Org. Rem., Decade 1, p. 12.
Raphistoma lenticularis Hall, 1862: Geol. Sur. Wisconsin, p. 39, fig. 4.
Raphistoma lenticularis Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 316, pl. ii, fig. 7b.

Shell lenticular, the breadth being about twice the height, nearly equally convex above and below; whorls four to five in number, flattened above, sharply carinate around the periphery, and rather convex below; suture not well defined; umbilicus broad; aperture rhomboidal in outline. Surface unknown in Missouri specimens.

Horizon and localities —Lower Silurian, Trenton limestone: McCune (Pike county).

Maclurea magna (LE SUEUR).

Plate iii, figs. 9a-b.

Maclurites magna Le Sueur, 1818: Jour. Acad. Nat. Sci., Phila., vol. I, p. 312, pl. xiii, figs. 1-3.
Maclurea magna Hall, 1847: Pal. New York, vol. I, p. 26, pl. v, figs. 1a-d.

Shell rather large, composed of three or more volutions, rapidly increasing in size; flattened above, rounded and carinated below. Surface marked only by lines of growth.

Horizon and localities.—Silurian, Trenton limestone: Glencoe, McCune station (Pike county), Allerton (St. Louis county), Bailey landing (Perry county).

Phanerotinus paradoxus Winchell.

Plate iii, fig. 7.

Phanerotinus paradoxus Winchell, 1863: Proc. Acad. Nat. Sci, Phila., p. 21.
Phanerotinus paradoxus Hall, 1879: Pal. New York, vol. V, pl. ii, p. 60, pl. xvi, fig. 16.
Ecoyliomphalus paradoxus Miller, 1890: N. A. Geol. and Pal., p. 403.

Shell rather small, planorbiform; volutions not contiguous, about four in number, very gradually enlarging to the aperture, which is circular. Surface smooth, with indistinct lines of growth.

Horizon and localities. — Lower Carboniferous, Lower Burlington limestone: Louisiana (Pike county).

Genus Capulus Montfort.

Until quite recently there has always been a considerable diversity of opinion as to what term should be really applied to the Paleozoic group of gasteropodous shells commonly referred, by most American writers, to Platyceras of Conrad. The described species of this group have been variously and indifferently assigned to Capulus, Montfort, Pileopsis, Lamarck, Actita, Fisher von Waldheim, Platyceras, Conrad, Acroculia, Phillips, Orthonychia, Hall, and some other genera. Of these, Capulus and Platyceras have become at last generally adopted, the former having preference with most European and the latter with the majority of American authors.

The two genera last mentioned are practically co-extensive, and since the first has precedence—of more than thirty years—it should be used instead of the second. Even if the group to which Conrad gave the name Platyceras were a valid one, it is very questionable whether the term could stand, inasmuch as it has been pre-occupied for three-quarters of a century. It has long been known that Geoffrey in 1764 proposed for a genus of Coleoptera the name Platyceras, a term which was later employed by Latreille, and which continues to the present

day in good usage as originally proposed. Taking advantage of this fact, Œhlert has recently revived Phillips' name Acroculia for the Platyceras group of shells; but this of course cannot be adopted.

The leading characters of generic value in modern Capulus, as shown by the more typical shells, as *C. hungaricus* Linnæus, are the obliquely conical shape, the small, often closely incurved or coiled spire, the broad campanulate apertural portions, and the pecular horseshoe-shaped muscular impressions. In the Paleozoic forms heretofore referred to Platyceras, these features have been made out most clearly in *C. paralius* (W. & W.) and *C. equilateralis* (Hall); though the affinities are not less striking in many other species.

There is often considerable embarrassment in attempting to separate certain Paleozoic Capuli, on the one hand from some forms of Platystoma, especially from those species in which there is a greater or less tendency for the shells to uncoil; and on the other hand, from various genera of Patelloid shells. As might be expected in a group of gasteropods presenting so few constant characters which may be satisfactorily relied upon as classificatory criteria, it is often impossible to clearly distinguish between certain of these species.

Among the first to notice the existence of Carboniferous Capuli in the continental interior were Yandell and Shumard, who called attention to the association of a species with an Acrocrinus (afterward described by the former author as *A. shumardi). Orthonychia acutirostre,* however, was the first species of this group of gasteropods described from the Carboniferous rocks of the Mississippi basin; and was so denominated by Hall in 1856. The publication of this diagnosis was followed in quick succession by definitions of other forms by Stevens, Hall, Swallow, McChesney, Winchell, White and Whitfield, and Meek and Worthen.

Variation in Form.—It has been noted frequently in the descriptions of various Paleozoic species of Capulus, that the shells often present a more or less well-defined quinquelobate appearance, and that the apertural margins are for the most

part sinuous or crenate. In the absence of salient classificatory characters these features were regarded usually of much importance for specific distinction. It was not until a comparatively recent date that their true significance was indicated. The fact here referred to is the attachment of fossil Capuli to foreign bodies, and particularly to the calyces of crinoids. The observations on this habit of the ancient Capuli have been fully considered elsewhere, but may be here briefly summarized by stating that in all the examples examined—upward of several hundreds—(1) the gasteropod shell invariably lies over the anal opening of the crinoid; (2) the mollusk remained in this position for a considerable period, probably for the greater part of life, as is shown by the shells on highly-ornamented calyces, and by the removal of them from their places of attachment, and tracing the growth of the shell by the concentric grooves made on the ventral plates; (3) the growing shell followed closely the inequalities of the surface upon which it rested—depressions giving rise to furrows and protuberances to folds or nodes; and (4) shells simply lying on flat surfaces are much more depressed and proportionally broader than those clinging to the vertical or inclined portions of calyces where the anal opening is situated laterally. The third of these statements is perhaps best illustrated by crinoids having low interradial areas and elevated radial regions; and this is the probable explanation of the frequent occurrence of the more or less distinctly five-lobed calyptræan shells. Heretofore this phenomenon has admitted of no direct causal interpretation.

Attachment to Crinoids.—The adherence of gasteropods of the genus under consideration to fossil crinoids was at first thought to furnish conclusive evidence of the carnivorous habits of the Crinoidea; and inasmuch as it was at that time considered that the aperture in the vault was the mouth, this explanation seemed very plausible. Consequently, the conclusion was very naturally reached that the crinoid, when it perished, was in the act of devouring the mollusk. Meek and Worthen appear to be the first to question the prevalent opinions regarding the intimate association of crinoid and gastero-

pod; and to suggest that the mollusk was, in all probability, stationed on the echinoderm for a protracted period, perhaps even for the greater portion of its life. But notwithstanding the fact that the univalve was almost invariably situated over the ventral aperture, and that this opening was recognized as the anus, these writers do not seem to entertain for a moment the idea that the gasteropod may have been nourished upon the refuse matter from the crinoid. The latter view is now favorably received by most paleontologists. In every instance of the several hundred specimens lately examined, the calyptræan covers the anal opening of the crinoid; and, so far as observable, it is always the anterior portion of the molluscan shell that is directed to the vault aperture. In those examples where the shell has been removed, its impression made on the ventral surface shows that the anterior margin of the peristome was at the edge of the opening in the dome, a position that would have brought the mouth of the mollusk directly over the anus of the crinoid. From an examination of the concentric markings made by molluscan shells on the tests of Strotocrinus and Platycrinus, it appears that the forward end of the Capulus was always stationary at the margin of the dome opening; and that, as the growth of the shell continued, the posterior portion was removed farther and farther from the ventral aperture of the crinoid.

The food of recent crinoids consists chiefly of animalcules and microscopic plants, and the living Calyptræidæ subsists on food of a similar nature. From analogy it might be inferred that the food of fossil crinoids and mollusks must have been similar to that of their modern representatives. So far as the echinoderms are concerned, there seem to be no serious objections to this inference. But with the univalves their position through life indicates that their sustenance was, in great part at least, of a somewhat different character.

The anatomy of the crinoid and the position of the molluscan shell are not in accord with the supposition that the calyptræan may in any way have been nourished on the food of the crinoid. This would imply that the gasteropod was par-

asitic in its habits—a view which, though held by most writers, does not appear to be structurally substantiated. While no doubt the Capulus derived the greater part of its food from excrementitious matter, nourishment from other sources may also have been obtained, and in all probability it was very similar to that of the crinoids and the living Calyptræidæ. Furthermore, there does not seem to be the slightest indication that the crinoid was in any manner inconvenienced by the attachment of the gasteropod, except, perhaps, in a few cases where the molluscan shell had encircled the posterio-lateral arms, which were in consequence slightly pressed outward. The only really noticeable effect of the presence of Capulus on the crinoid is a comparatively shallow depression or groove on some of the ventral plates, marking the position of the shell lip; though in the majority of specimens even this feature is not well pronounced. There are no grounds for the view advanced by Trautschold in regard to *Cromyocrinus simplex* Trauts. and its adhering *Capulus parasiticus* Trauts. from the Lower Carboniferous of Russia, that the crinoid built a cylindrical process upon the anal plate as a protection against the sedentary gasteropod.

Illustrative Examples.—In some crinoids, as Gilbertsocrinus, the plates of the vault are more or less convex or nodose. This nodosity of the ventral plates reaches a high development in such forms as *G. tuberosus* Lyon and Casseday. Nearly one-half of the known individuals of this species have a gasteropod adhering. The specimens illustrate well the adaptation of the apertural margin of the shell to the irregularities of the crinoidal surface; for it is clearly observable, as first pointed out by Meek and Worthen, that the contact of the gasteropod shell and crinoid is not the result of accidental pressure, but that the mollusk adhered to the surface of the crinoid for a considerable period, as is shown by the sinuosities of the peristome corresponding exactly to the inequalities of the surface beneath. In young shells the sinuosities of the apertural margin are comparatively much more pronounced than in older individuals. Many of the latter exhibit much irregularity in

the lines of growth, which might at first appear to be due to a change of station, but closer inspection shows that this is not the case. When the plates of the crinoidal vault are nodose, as in *Gilbertsocrinus tuberosus* the lines of growth in adult shells, contrary to the more usual manner among gasteropods generally, are far from being even approximately parallel to one another; and in the lip of the shell a sinus, caused by a nodose plate at one period of growth, may be represented in the next by a projecting lobe, which extended into a deep depression between the nodes of two contiguous plates.

In considering the structural peculiarities of the Capulus shell, three features—the general form, the configuration of the aperture, and the surface makings—appear to have been susceptible of considerable modification as the result of the sedentary habits of the mollusk. An examination of a large series of certain species of the genus reveals the fact that the variant tendency in all three of these particulars is much greater than might be supposed; and when the attachment of these gasteropods to foreign bodies is taken into consideration, the causes for such varietal development become manifest. It has been shown that the mollusk doubtless remained fixed throughout a greater portion of life, and that the surface upon which it first settled determined in great part both the form of the shell and the shape of its aperture. When the surface of attachment was flat, as in the vaults of Gilbertsocrinus and Strotocrinus, the molluscan shell was greatly depressed and the peristome ample; but when the foreign body was strongly convex the shell was more conical, with a comparatively much smaller aperture. It has been stated elsewhere that, in regard to the second of the three variant features observable in the calyptræan shell, the margin of the peristome partakes of all the inequalities of the surface to which the gasteropod adheres. Few of the species attached to crinoids may be said to have true surface ornamentation, for the longitudinal folds or plications in the shell are in many cases due chiefly to the character of the surface of attachment. In some specimens of *Igoceras pabulocrinus* (Owen) there have been noticed, in addition to

the undefined longitudinal folds, several series of small conspicuous nodes; but these in all examples seem to result from the peculiar nodose ornamentation of *Platycrinus hemisphericus* with which the univalves are associated.

It appears, then: (1) that some, if not the majority of the ancient Capuli were stationary during life; (2) that the nourishment of many of these sedentary gasteropods was derived, in great part at least, from the excrementitious matter from crinoids; and (3) that the form of the peristome and its marginal configuration, being dependent upon the surface of attachment, have small value as characters for specific distinction.

Range of Variability.—Among modern gasteropods, attention of late has been called frequently to the variation in the form of the shell as the result of differences in the local conditions of station. In the extension of this inquiry to fossil groups many difficulties are met with, among which the most formidable, perhaps, is the inability to obtain enough material for an adequate consideration of the subject. Usually the

FIGS. 10 and 11. Variation of Capulus equilateralis (Hall).

shells of any one species are not abundant locally, nor is the representation from localities, more or less widely separated geographically, sufficient to permit of satisfactory comparisons. Lately Capulus has unexpectedly furnished a very interesting series illustrating the range of variation in several species. The comparison is perhaps most striking in the projection of ten specimens of *Capulus equilateralis* as recently graphically represented. (Figures 10 and 11.) The case referred to is only a

single one of many to be found among the mollusca. It is very significant in its bearing upon the true basis of species, and indicates plainly, that in attempting to separate specimens specifically, too much stress should not be placed upon individual characters.

Other Causes of Variation.—In connection with variation of species, it is of great interest to note the apparent effect of gravitation in altering the form of some gasteropod shells. This phase may be more satisfactorily considered in *Capulus equilateralis* and *I. pabulocrinus* than in most other species, because when attached to the vaults of crinoids, the station of each individual is definitely known. As stated already, the first of these forms generally rests on flat-vaulted crinoids, while the second commonly adheres laterally to such echinoderms as *Platycrinus hemisphericus* *Capulus equilateralis* when occupying the same position is pendant, the apex of the shell being directed downward instead of in the opposite direction, as when resting on the ventral surface of such forms as Gilbertsocrinus. The shell thus pendant exhibits a decided tendency to straighten, or uncoil, consequently becoming longer, the apex freeing itself completely from the body-whorl. In comparison, therefore, with a representative example of *C. equilateralis*, those shells resting on flat crinoidal vaults are very much depressed, the aperture proportionately broader and the spire more closely coiled. Those individuals attached laterally to crinoids have a tendency to become more conical, the aperture being relatively smaller, while the spire is entirely free from the last volution, and the apex often extends to a considerable distance beyond the posterior margin of the aperture.

On the other hand, *I. pabulocrinus* is commonly a more or less elongate conic shell. When attached to Platycrinus it often assumes a very different aspect. As growth proceeds the posterior side becomes relatively shorter, the apex slightly curved backward, and not unfrequently there is a marked tendency toward a strongly arcuate form.

The Kinderhook forms of the genus are, on the whole, extremely unsatisfactory for systematic determination, since the

most of them are merely internal casts. They form, however, an important feature of the fauna inclosed in these rocks. The Burlington and Keokuk species are very closely related, and in part extend through both epochs, after which the genus is of rare occurrence in the continental interior. It is of considerable interest to note that this numerical reduction after the close of the Keokuk was accompanied by a marked depauperization of the individuals which struggled through to the end of the Paleozoic. Through all the St. Louis, Kaskaskia and Coal Measures the species, without exception, are diminutive. The *O. acutirostre* of the St. Louis became reduced to nearly one-half the size it possessed in the Keokuk, notwithstanding the fact that this species had perhaps a wider geographical range than any other congeneric form occurring within the Mississippi basin, and was therefore better adapted to preserve its full vigor, at least in some parts of its distribution.

Structural Characters.—Shell depressed, subglobose, obliquely subconic; body-whorl very large. Aperture ample, expanded; labrum more or less sinuous, inner lip not anchylosed to the spire. Surface glabrate, plicate, or sometimes spiniferous; lines of growth often umbricate.

The shells which have been referred to Platyceras present a manifold variety of forms. It is, therefore, not improbable that a fuller examination and comparison of all the known species will demand a somewhat different arrangement and subdivision of the group than that now existing. In this section the shell presents few salient characters for consideration. As already stated, it is often with extreme difficulty that the forms of this group can be satisfactorily separated from certain varieties of Platystoma and various genera of Patelloid shells. In general, however, the test of Capulus is coiled, subspiral, arcuate or subconic, with a relatively small spire and an immense, rapidly expanding body whorl, while the surface is usually without ornamentation. The large majority of the species of this group possess tough, massive shells, which are generally, therefore, in a much better state of preservation than most of the associated molluscan remains.

Muscular Scars.—The internal scars so prominent in the shells of living Capulus and modern allied genera are seldom observable in Paleozoic forms. Hence, having never noticed in individuals of the latter the peculiar horseshoe-shaped impressions, Hall assigns this as the only reason for regarding Capulus and Platyceras as distinct genera. Since the time that the American author first expressed this opinion, a sufficient number of fossil examples have been found to indicate clearly the real nature of these scars. A careful comparison shows that they are not very different from those of typical Capuli, though considerable variation is noticeable in the several forms, and even in shells of the same species.

As exhibited in *I. pabulocrinus*, and some other species, the muscular scars are connected by a narrow band traversing the posterior side of the shell. In adult examples, the scars are situated about one-fourth the distance from the apertural margin to the apex. In some excellent internal casts of *Capulus protei* (Œhlert) from the lower Devonian of Mayenne, the muscular impressions are somewhat different from those of congeneric species from America. The scar on the right side is comparatively large, oval and well defined; a narrow sinuous band passes around the spire posteriorly and terminates on the left side in an enlarged scar similar to but much smaller than that on the right. In some specimens the linear band does not appear to be perfectly continuous from one side to the other.

Capulus subsinuosus (Worthen)

Platyceras subundatum Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 387, pl. vii, figs. 13a-b and 14a-b. (Not Conrad, 1841.)
Platyceras subsinuosum Worthen, 1882: Illinois St. Mus. Nat. Hist., Bul. 2, p. 38.

Shell composed of about three and one-half rounded volutions, the first two and a-half or three of which increase rather rapidly in size, are closely coiled together, and depressed with the spire on a level with or below the upper side of the outer turn; body portion very rapidly expanding, so as to cause the upper side to rise considerably above the inner turns, with which, however, it continues very nearly or quite in contact,

even to the aperture, which is large and sub-circular, or transversely oval; lip with its margin all around, excepting on the inner side, undulated so as to form some eight or ten more or less well-defined sinuses, with projecting processes between. Surface marked only by fine undulating lines of growth.

Horizon and localities.—Upper Silurian limestone: Bailey landing (Perry county).

As in the case of a considerable number of other shells from the Mississippi basin, it is almost impossible to detect any specific differences between them and the more eastern forms; and it is very likely that the specimens under consideration will have to be referred to some one of the New York species described by Hall.

Capulus haliotoides (MEEK & WORTHEN).

Plate liii, figs. 9a-b.

Platyceras haliotoides Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., 1866, p. 264.
Platyceras haliotoides Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p.458, pl. xiv, figs. 3a-b.
Capulus haliotoides Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 165.
Platyostoma broadheadi Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 86, pl. xiv, figs. 19-20.

Shell below medium size, very obliquely ovate, forming one to two very rapidly expanding volutions, which are contiguous except near the apertural margin; whorls compressed, somewhat sharply rounded along the periphery. Spire slightly elevated above the level of the body turn. Aperture ample, oval; labrum somewhat sinuous. Surface marked by fine unlating lines of growth.

Horizon and localities.—Lower Carboniferous, Kinderhook limestone: Sedalia.

Capulus paralius (WHITE & WHITFIELD).

Plate liii, figs. 1a-d.

Platyceras paralium White & Whitfield, 1862: Proc. Boston Soc. Nat. Hist., vol. VIII, p. 302.
Platyceras paralius Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 294.
Capulus paralius Keyes, 1890: American Geologist, vol. VI, p. 9.
Capulus paralius Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 166, pl. ii, figs. 1a-b.

Platyceras nasutum Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 82, pl. xiv, figs. 17-18.

Shell like that of an immature *O. equilateralis,* but much thinner and more delicate.

Horizon and localities.—Lower Carboniferous, Chouteau limestone, Sedalia; Burlington limestone: Louisiana.

The apical portion of the shell is more slender and extended than the type would indicate from casual examination. The typical specimen has the longitudinal folds much more prominent than is apparent in an average example of the species; for in the majority of individuals the plications are scarcely noticeable. This species is widely distributed geographically, and preserves its individuality remarkably over its entire range. Typical specimens have been collected at LeGrand, in central Iowa, at Burlington, in the southeastern part of the same state, at Lodi, Ohio, and Sedalia, in west-central Missouri.

Careful comparisons of the Sedalia specimens described by Miller, and those from other localities mentioned, leave little room for doubt that the recently named *Platyceras nasutum* is anything else than the same form noted more than 30 years ago, by White & Whitfield, under the title of *P. paralium.*

Capulus tribulosus (White).

Plate liii, figs. 11a-c.

Platyceras tribulosum White, 1883: U. S. Geol. Sur. Terr., 12th Ann. Rep., p. 186, pl. xli, figs. 6a-b.
Platyceras tribulosum Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 290.
Capulus tribulosus Keyes, 1890: Am. Geol., vol. VI, p. 9.
Capulus tribulosus Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 170, pl. ii, figs. 4a-b.

Shell rather below medium size, subspiral, rather slender, forming about one volution; regularly expanding to the aperture. Apex incurved, far removed from the body of the shell. Aperture irregularly oval; usually more or less broadly lobed posteriorly; lip sharp, irregular, with usually a deep sinus anteriorly. Surface glabrate, but exhibiting numerous fine, closely arranged lines of growth; also marked by three longi-

tudinal series of long tubular spines, extending from the apertural margin about three-fourths the distance to the apex. Of these spiniferous rows two are disposed laterally, one on each side and the third centrally and dorsally.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal, Louisiana.

This is one of the few spiniferous species belonging to the genus Capulus; and only two others of similar character occur in the American Carboniferous rocks. It appears to be closely allied to *C. biserialis* (Hall), and may eventually prove identical with that form, from which it apparently differs only in having three, instead of two, rows of spines. Thus far it has been noted only in the two divisions of the Burlington limestone, when it occurs in the thin sandy-clay partings, associated with delicate and beautifully preserved bryozoans. The type specimen is not a characteristic representative of the species, being in several particulars quite abnormal.

Capulus latus (Keyes).

Plate liii, figs. 18a-b.

Platyceras latum Keyes, 1888: Proc. Am. Philosophical Soc., vol. XXV, p. 242, figs. 10-11. (Reprint, p. 14.)
Platyceras latum Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 290.
Capulus latus Keyes, 1890: Am. Geologist, vol. VI, p. 9.
Platyceras latum Miller, 1890: N. A. Geol. and Pal., p. 416.
Capulus latus Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 168.

Shell somewhat like *C. equilateralis* in general physiognomy, but more campanulate, and with the apical parts relatively smaller.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Burlington (Iowa); Hannibal.

This form is seldom well preserved, the majority of the specimens being more or less exfoliated.

Capulus obliquus (KEYES).

Plate liii, figs. 14a-b

Platyceras obliquum Keyes, 1888: Proc. Am. Philosophical Soc., vol. XXV, p. 141, figs. 12-13. (Reprint, p. 13.)
Platyceras obliquum Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 290.
Capulus obliquus Keyes, 1890: Am. Geologist, vol. VI. p. 9.
Capulus obliquus Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 168, pl. ii, fig. 3.

Shell of medium size, irregularly oblong, subspiral, forming one volution; regularly enlarging, slightly more rapidly transversely than in the opposite direction, to the aperture. Apex large, obtuse, far removed from the body of the shell, which is broadly arcuate; very noticeably oblique to the plane of general curvature in the body of the shell. Aperture irregularly quadrangular in outline; margin sharp and more or less sinuous. Surface marked by several undefined plications, which sometimes form longitudinal series of obscure nodes; these are crossed by numerous sinuous, often somewhat imbricated, lines of growth.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal; Burlington (Iowa).

Capulus biserialis (HALL).

Plate liii, figs. 12a-b.

Platyceras biserialis Hall, 1859: Geology Iowa, vol. I, pt. ii, Supp., p. 90.
Platyceras biserialis Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 509, pl. xv, figs. 3a-b.
Capulus biserialis Keyes, 1890: American Geologist, vol. VI, p. 9.
Capulus biserialis Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 167.

This species is similar to *Capulus tribulosus* (White), but has only two, instead of three, longitudinal rows of spines.

Horizon and localities.—Burlington limestone: Quincy, Illinois.

A marked characteristic of this form and also of *C. tribulosus* (White) is, that the tubular spines are arranged in longitudinal rows, while in the few other American spine-bearing Capuli, there is no regularity in the distribution of the spinous processes. The spines are easily broken, and hence are seldom preserved to their full length; often they are scarcely noticeable.

Capulus equilateralis (Hall).

Plate iii, figs. 10a-b.

Platyceras equilatera Hall, 1858: Geology Iowa, vol. I, Supp., p. 89.
Platyceras equilatera Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 518, pl. xvii, fig. 2.
Platyceras equilateralis Miller, 1877: Cat. Am. Pal. Foss., p. 156.
Platyceras equilatera White, 1880: Geol. Sur. Indiana, p. 514, pl. vii, fig. 5.
Platyceras equilatera Keyes, 1888: Proc. Am. Philosophical Soc., vol. XXV, p. 236, figs. 2 and 3.
Platyceras equilatera Keyes, 1889: American Geologist, vol. III, p. 331.
Platyceras equilatera Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 288.
Capulus equilateralis Keyes, 1890: American Geologist, vol. VI, p. 9.
Capulus equilateralis Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 171, pl. ii, fig. 11.

Shell of medium, but often attaining a large size; extremely variable, hemispherical to oblique conical, with incurved spire; volutions one to two in number, free or contiguous, moderately enlarging for some distance from the apex, and then rather abruptly and rapidly expanding. Aperture very large, broadly oval, or often nearly circular; lip thin, more or less undulating. Surface smooth, but toward the apertural margin exhibiting numerous, often strongly imbricating, sinuous lines of growth. Frequently many small obscure longitudinal folds are also present.

Horizon and localities.—Keokuk limestone and shales: Wayland (Clarke county); Keokuk and Bonaparte (Iowa); Warsaw and Niota (Illinois). Burlington limestone: Burlington (Iowa); Springfield (Greene county).

This species seems to be one of the most abundant gasteropods of the Keokuk beds. Some of the shells often attain very considerable measurements: height, 45 mm.; length along the dorsum, 95 mm.; breadth, 60 mm. Not only is the species under consideration variable in size, but it is extremely so in form and in the configuration of the apertural margin. Perhaps no Capulus in all the Carboniferous presents so wide a range of variation as does this species. Immature shells appear to be glabrate, but as growth proceeded they became more and more rugose and imbricate. The spire is as often contiguous as free and simply incurved; and in adult specimens it

is relatively very small. The longitudinal folds are not unfrequently very pronounced, and being few in number, impart a peculiar trilobate appearance to the shells; in other examples all traces of plications are wanting.

The extensive series of *C. equilateralis* from the Crawfordsville shales has been very thoroughly studied of late, disclosing many interesting phases of the habits of these gasteropods, hitherto not elsewhere presented in such an eminently satisfactory manner. At this locality the shell is usually attached to the calyx of *Gilbertsocrinus tuberosus* (Lyon and Casseday), but the mollusk is not invariably associated with this particular species of crinoid, as Meek and Worthen supposed. A number of typical examples of the Capulus in question have been observed adhering to *Platycrinus hemisphericus* (Meek and Worthen), with which, however, is more commonly associated *I. pabulocrinus* (Owen). In Gilbertsocrinus the vault is relatively large, nearly flat, with the anal opening located midway between the center and margin. In both *G. tuberosus* (L. & C.), from the Keokuk shales, and *G. typus* (Hall), from the Burlington limestone, the ventral plates are convex, or, as in many specimens, very nodose. The growing margin of the gasteropod shell having adapted itself exactly to the irregularities of the surface of the crinoidal vault, necessarily was always more or less deeply sinuous, each sinus being produced by the nodosity of the vault plate in contact; while the small linguiform projection between two sinuses extended down between the nodes of two contiguous plates. The extreme nonparallelism of the lines of growth, so conspicuously evident in the shells of many ancient Capuli, is thus capable of being traced, and especially in those examples in which the nodosity of the dome plates of the crinoid has reached a high development. This phenomenon of nonparallelism of the lines of growth is not therefore indicative of a change in station of the gasteropod, as has been suggested at various times.

It has been clearly shown elsewhere that shells of *C. equilateralis*, when adhering to flat surfaces, are always very much depressed and have the aperture proportionately much more

expanded than the average specimen, while the spire is closely incurved, even touching the body of the shell. When the gasteropod is found attached to strongly convex surfaces, or to the calyces of Platycrinus, the shell enlarges less rapidly, and there is also a tendency for the apex to become free from the body-whorl, and even to completely uncoil, often to such an extent as to approach closely some forms of the *I. pabulocrinus* type.

Owen apparently had this form in hand when he figured a shell as *Ancella crasicollis* from the Keokuk rapids of the Mississippi river, where it occurs quite abundantly. Its manner of preservation, however, tends greatly to obscure its real character; and it is doubtless for this reason chiefly that Owen failed to detect the true nature of the form.

Capulus ovalis (Stevens).

Acroculia ovalis Stevens, 1858: Am. Jour. Sci., (2), vol. XXV, p. 261.
Platyceras lævigatum Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 263. (Not *Acroculia lævigata* McCoy.)
Capulus ovalis Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 176.

Shell very small, subglobose; volutions about two and one-half in number, contiguous, rather rapidly expanding; spire very small.

Horizon and localities.—Kaskaskia limestone: Union and Randolph counties, Illinois; Ste. Genevieve county, Missouri.

Capulus ovalis is one of the smallest of the lower Carboniferous Capuli, having a height of only three to six millimeters and a maximum breadth of eight millimeters.

Capulus parvus Swallow.

Plate liv, figs. 5a-b.

Capulus parvus Swallow, 1858: Trans. St. Louis Acad. Sci.. vol. I, p. 205.
Platyceras nebrascense Meek, 1872: U. S. Geol. Sur. Nebraska, p. 227, pl. iv, fig. 15.
Platyceras nebrascense White, 1875: U. S. Geog. Sur. w. 100 merid., vol. IV, p. 159, pl. xii, fig. 5.
Platyceras nebrascense White, 1884: Geol. Sur. Indiana, Rept. for 1883, p. 159, pl. xxxii, figs. 15 and 16.
Capulus parvus Keyes, 1890: American Geologist, vol. VI, p. 9.
Capulus parvus Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 178, pl. ii, figs. 14a-c.

Shell like *O. tribulosus* (White), but without spines, and with the apex inclined quite noticeably to the right.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

A careful comparison shows the form described from Nebraska by Meek is only a more matured individual of *O. parvus*. Since, however, Swallow's species was poorly defined and was never figured, and as Meek was the first to give a clear diagnosis of this form, both by a full description and by good illustrations, it is, perhaps, questionable whether Meek's name should not really be retained for the form, *Platyceras nebrascense* having been almost universally applied to this species as occurring throughout the West.

Genus IGOCERAS Hall.

The reasons for reviving Hall's generic term Igoceras have already been stated fully elsewhere. It is proposed to apply the name only to certain more or less distinctly conical shells which were originally under Conrad's abandoned genus Platyceras. The following American species may be considered as properly belonging here:

Platyceras conicum, Hall.
P. perplexum, Hall.
P. plicatum, Hall.
P. pyramidatum, Hall.
P. capulus, Hall.
P. subplicatum, Meek & Worthen.
P. quincyense, McChesney.
P. fissurella, Hall.
P. pabulocrinus, Owen.

Igoceras pyramidatum (Hall).

Platyceras pyramidatum Hall, 1859: Pal. New York, vol. III, p. 336, pl. lxiv, figs. 7, 9.

Platyceras pyramidatum Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 339, pl. vii, fig. 11.

Shell much like that of *I. pabulocrinus*, but more ventricose, and the sides convex instead of nearly straight.

Horizon and localities.—Upper Silurian limestone: Bailey landing (Perry county).

Igoceras quincyense (McChesney).

Plate liii, figs. 10a-b.

Platyceras quincyense McChesney, 1861: Desc. New Foss. Palæ. Rocks West. States, p. 90.
Platyceras quincyense McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 46, pl. vi, figs. 6a-b.
Platyceras (*Orthonychia*) *quincyense* Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 510, pl. xv, figs. 5a-b.
Platyceras quincyense Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 290.
Capulus quincyensis Keyes, 1890: American Geologist, vol. VI, p 9.
Capulus quincyensis Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 168, pl. ii, fig. 9.
Platyceras pettiense Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 81, pl. xiv, fig. 1.
Platyceras missouriensis Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rept., Adv. sheets, p. 83, pl. xiv, fig. 2.

Shell of medium size, broadly conical, often more or less elongated; expanding very rapidly and regularly from the central or sub-central apex to the aperture. Usually five broad, rounded ridges extend from near the apex to the aperture, which is consequently more or less prominently quinquelobate; the ridges are not unfrequently further divided into two or more smaller folds. Lip sharp, sinuous. Surface marked by subimbricating lines of growth, and also by numerous small, often undefined, longitudinal costæ, which do not appear in the cast.

Horizon and localities.—Burlington limestone: Burlington (Iowa), Quincy (Illinois); Sedalia.

The specimens described by McChesney and by Meek and Worthen, were either exfoliated examples or internal casts; and this is the condition in which the species is usually found. Owing to the peculiar state of preservation, the shells quickly crumble away in handling, leaving only the internal casts, but the distinctive quinquelobate character always renders them easily recognizable. In the examples figured by McChesney, and also by Meek and Worthen, the apices are wanting, but the individuals were not as imperfect as was supposed.

During the earlier period of their growth many of the shells of *I. quincyense* were very broad, but when attaining about one-third their maximum size, the aperture abruptly

became relatively smaller, leaving a sharp sub-angular ridge around the shell, parallel to the apertural margin. This abrupt decrease in the expansion of the shell imparts to the natural internal casts the appearance of an apical truncation or fracture.

In its attachment to Paleozoic crinoids, the only form with which *I. quincyense* has thus far been found associated is *Physetocrinus ventricosus* (Hall) a species having a rather depressed hemispherical dome, in which the ventral opening has a subcentral location. The dome-plates are small and numerous, and frequently studded with small prominent tubercles or sub-spinous processes, which impart to the gasteropod shell series of minute corrugations extending over each of the larger folds.

Igoceras capulus Hall.

Plate lii, figs. 1a-b.

Platyceras capulus Hall, 1859: Geology Iowa, vol. I, Supp., p. 19.
Metoptoma umbella Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 267.
Metoptoma umbella Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 506, pl. xv, figs. 6a-c, and 7.

Shell conical, much depressed, with a few broad, more or less obscurely defined longitudinal folds; apex nearly central. Aperture very large, circular in outline; lip somewhat undulating. Surface marked only by lines of growth. The muscular scars, as observed in some specimens, consist of curved, oblong impressions on each side, united behind by a narrow band.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal, Ritter station (Greene county).

Although much more depressed than any other known form of the genus, there seems to be but little doubt, at present, that the shell under consideration properly belongs to the same group as *I. pabulocrinus* of Owen. Hall's original description was rather incomplete and unaccompanied by illustrations of any kind, besides being published in an obscure place; but the common occurrence of the species at the typical locality leaves no room for reasonable doubt as to the shell Hall had

in-hand. In regard to Meek & Worthen's *Metoptoma umbella*, there appear to be no good grounds for considering it as distinct from Hall's form.

Igoceras pabulocrinus (Owen).

Plate lii, figs. 3a-b, and pl. liv, figs. 8a-l.

Platyceras subrectum Hall, 1859: Geology Iowa, vol. I, Supp., p. 89. (Not *P. subrectum* Hall, 1859.)
Platyceras subrectum Hall, 1860: Twelfth Ann. Reg. Rept., Univ. N. Y., p. 18. (Not *P. subrectum* Hall, 1859, New York shell.)
Pileopsis pabulocrinus Owen, 1862: Geol. Sur. Indiana, p. 365, fig. 8.
Platyceras infundibulum Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 266.
Platyceras extinctor Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 266. (Never formally proposed.)
Platyceras infundibulum Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 517, pl. xvii, fig. 3.
Platyceras infundibulum Keyes, 1888: Proc. Am. Philosophical Soc., vol. XXV, p. 238, fig. 1.
Platyceras infundibulum Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 289.
Capulus infundibulum Keyes, 1890: Am. Geologist, vol. VI, p. 9.
Capulus infundibulum Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 174, pl. ii, fig. 10.

Shell more or less conical, often somewhat oblique, with usually many undefined longitudinal folds; apical portions slender, expanding regularly at first and then more rapidly. Apex attenuated, often slightly deflected toward the posterior side. Surface smooth, but toward the aperture marked by numerous undulating, frequently imbricating lines of growth.

Horizon and localities.—Keokuk limestone and shales: Keokuk, Iowa; Warsaw, Illinois; Crawfordsville, Indiana. Burlington limestone: Burlington (Iowa); Springfield (Greene county).

The name *pabulocrinus* was given to the species under consideration for the reason that the mollusk was thought to form the food of crinoids, since it was often found adhering to the calyx of the echinoderm directly over the opening in test. This explanation appears quite plausible; but long ago this view was proved false. Owen gave practically no description of the shell; and his figure was roughly executed, showing hardly anything more than the bare outlines of the

specimen. The illustration, however, represents the gasteropod attached to the side of the common and well-known crinoid *Platycrinus hemisphericus* Meek and Worthen, so that not the slightest doubt is entertained as to which shell it was intended to portray. Besides, at Crawfordsville, this mollusk is almost invariably associated with the crinoid just mentioned. Only two other species of the genus—*C. equilateralis* and *C. sulcatinus*—are known to occur at the Indiana locality, and these are both very different. Taking all things into consideration, therefore, and remembering that Hall's name *Platyceras subrectum* had been preoccupied, it seems advisable to restore Owen's title for the shell in question.

The form most closely allied to this species is *C. fisurella* (Hall), from which it is distinguished in being proportionally more elongate, while the apical part of the shell is characteristically slender. Ordinarily the shell is more or less conspciuously plicate, but the folds are, for the most part, narrow, and usually irregular and broken.

For an elongated specimen, Meek & Worthen have indicated the name *Platyceras extinctor* "should it prove distinct," but the term cannot be regarded as having been actually proposed, while the form itself is manifestly only an attenuated internal cast of *I. pabulocrinus*. It, however, exhibits well the characteristic muscular impressions.

This species, like *C. equilateralis* (Hall), with which it is usually associated, occurs in the Burlington limestone and ranges through the Keokuk. Its association with crinoids at Crawfordsville, Indiana, has been for the most part with *Platycrinus hemisphericus* M. & W.; while at Burlington it adheres to a structurally similar form, *Eucladocrinus millebrachiatus* W. & Spr. The vault in the first species is very much elevated, and the anal opening is situated laterally between, and slightly above, two arm bases. The dorsal cup is ornamented by numerous conspicuous rounded tubercles. As the shell increased in size the pliant apertural margin encountered successively the different nodes, which caused the lip at these points to deflect outward, giving rise to variously shaped pro-

minences on the shell; when the tubercles were arranged in regular rows, there appeared a series of nodular plications. In many cases the gasteropod shell increased in size much faster than the echinoderm, and the lip of the shell consequently often encompassed the two posterio-lateral arms, and not unfrequently, also, the stem of the crinoid. The result was two large, deep sinuses in the anterior, and one similar indentation in the posterior margin of the shell. The effect of the tubercles was to impart a similar sinuous character to the entire margin, hence the lip was always crenated during the latter part of the mollusk's existence. The continual change in the nature of the surface upon which the gasteropod rested, also interfered with the uniform and regular growth along the apertural margin, and the lines of growth are consequently often strongly imbricated.

Igoceras fissurella (Hall).

Plate III, fig. 2.

Platyceras fissurella Hall, 1859: Geology Iowa, vol. I, Supp., p. 90.
Platyceras fissurella Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 519, pl. xvii, fig. 4.
Platyceras fissurella Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 289.
Capulus fissurella Keyes, 1890: Am. Geologist, vol. VI, p. 9.
Capulus fissurella Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 173.

The species under consideration is closely allied to *Igoceras pabulocrinus* (Owen), from which it differs chiefly in being much more depressed, with the aperture consequently very much larger in proportion to the size of the shell.

Horizon and localities.—Keokuk limestone: Warsaw and Nauvoo, Illinois; Burlington limestone: Burlington (Iowa).

The specific name of this form is very inappropriate, having originated in a misconception on the part of the author of the species as to the true nature of the apical perforation in the type specimen. It has been clearly shown by Meek and Worthen that the aperture in the apex is not a natural opening, but an accidental fracture in the shell.

Recently typical examples of *I. fissurella* have been found in the upper Burlington limestone, thus adding another case in support of the view lately advanced, that the faunas of the

Keokuk and Burlington limestones are much more intimately related biologically than had hitherto been generally regarded; and that many so-called Keokuk species are merely the subsequent genetic representatives of Burlington forms. The validity of their distinction simply on account of occurring in differently named geological horizons cannot be sustained. It is not to be supposed that the biologic sequence of two divisions, as the Burlington and Keokuk, so closely related stratigraphically and lithologically, and deposited under identical, quiet conditions should be so widely separated faunally as the described species from these limestones would indicate.

Genus Orthonychia Hall.

Under Conrad's generic name, a multitude of paleozoic gasteropods have been described. The genus has long been made to embrace a great variety of species, some of which are manifestly not at all closely related to one another genetically. Of these a few have been assigned lately to the groups to which they more properly belong. But there still remain a considerable number of shells which are clearly not members of the genus, but whose generic relationship cannot at present be determined with exactness. It is, however, some of the more familiar species commonly referred to Platyceras that are to be considered in the present connection.

These shells fall naturally into three groups, more or less easily distinguished by the general shape. One section is characterized by having a small, closely coiled spire more or less contiguous with the large campanulate body-whorl. Another group includes those shells having a very small spire, usually arched, but seldom closely coiled, the body-whorl being much elongated vertically, or often more or less distinctly spiral. A third section embraces the straight conical forms, having very little or no curvature to the spiral parts. To the first of these groups Montfort's generic title Capulus applies; for the second and third it seems advisable to revive Hall's names, Orthonychia and Igoceras. These groups may require eventually some further modifications, but they appear to satisfy all

present requirements, at least insofar as the American forms are concerned.

The following American shells are regarded as the most typical representatives of Orthonychia:

Platyceras subrectum, Hall.
P. dentalium, Hall.
P. concavum, Hall.
P. attenuatum, Hall.
P. unguiforme, Hall.
P. lamellosum, Hall.
P. spirale, Hall.
P. acutirostrum, Hall.
P. formosum, Keyes.
P. incile, Hall.
P. tubæforme, Hall.
P. curvirostrum, Hall.
P. agreste, Hall.
P. arcuatum, Hall.
P. tortuosum, Hall.
P. cyrtolites, McChesney.
P. chesterense, Meek & Worthen.

Orthonychia spirale (HALL).

Platyceras spirale Hall, 1859: Pal. New York, vol. III, p. 331, pl. lxiii, figs. 4-9.

Platyceras spirale Meek & Worthen, 1868: Geol. Sur. Illinois, vol. III, p. 389, pl. vii, figs. 2a–c.

Shell small, elongate, completely uncoiled, gradually increasing in size from the apex; body-whorl with a few broad longitudinal folds. Aperture subcircular, margin sinuous. Surface smooth, marked only by lines of growth.

Horizon and localities.—Upper Silurian limestone: Bailey landing (Perry county).

Orthonychia cyrtolites (MCCHESNEY).

Plate liii, fig. 15.

Platyceras cyrtolites McChesney, 1860: Desc. New Pal. Foss. West. States, p. 71.

Platyceras cyrtolites Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 288.

Capulus cyrtolites Keyes, 1890: American Geologist, vol. VI, p. 9.

Capulus cyrtolites Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 167, pl. ii, fig. 2.

Shell small, slender, arched; composed of about one volution; dorsally sub-angular, with a broad flattened area on each side; posteriorly somewhat plicate. Apical portion small, incurved, sometimes enrolled or contiguous. Aperture moderately large, sub-quadrangular; lip sharp, sinuous. Surface marked by strongly undulating lines of growth, which are often somewhat imbricated.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Hannibal.

This species appears to be genetically related to *O. acuti-rostre* (Hall), from the Keokuk; and eventually the two may prove identical.

Orthonychia formosum (KEYES).

Plate liii, fig. 2.

Platyceras formosum Keyes, 1888: Proc. Am. Philosophical Soc., vol. XXV, p. 242, figs. 8-9. (Reprint, p. 14.)
Capulus formosus Keyes, 1890: American Geologist, vol. VI, p. 9.
Capulus formosus Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 164, pl. ii, fig. 8.

Shell arcuate, enlarging rapidly to the ample, irregularly pentalobate aperture; longitudinally plicated.

Horizon and localities.—Lower Carboniferous, Kinderhook group: Marshall county, Iowa; Burlington limestone: Louisiana.

The two original specimens are attached to the ventral surfaces of specimens of *Dorycrinus immaturus* W. & Spr. At Louisiana the form occurs in chert nodules. This species resembles, in some respects, *C. paralius* (W. & W.), but is simply arcuate instead of being coiled.

Orthonychia boonvillense (MILLER).

Platyceras boonvillense Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 82, pl. xiv, figs. 15-1.

A rather small, regularly arched form, with a subcircular aperture.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Boonville.

Orthonychia acutirostre (HALL).

Plate liv, figs. 2a-c.

Capulus acutrostris Hall, 1856: Trans. Albany Inst., vol. IV, p. 31.
Capulus acutirostris Hall, 1858: Geology Iowa, vol. I, p. 665, pl. xxiii, figs. 14a-b.
Platyceras (*Capulus*) *acutirostris* McChesney, 1860: Desc. New Palæ. Foss. West. States, p. 71.
Platyceras uncum Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 264.
Platyceras uncum Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 516, pl. xvii, fig. 1.
Platyceras acutirostris Whitfield, 1882: Bul. Am. Mus. Nat. Hist., vol. I, p. 67.
Platyceras acutirostris Hall, 1883: Geol. Sur. Indiana, p. 370, pl. xxxi, figs. 13-15.
Capulus acutirostris Keyes, 1890: Am. Geologist, vol. VI, p. 9.
Capulus acutirostris Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 170.

Shell below medium size, rather slender, strongly arcuate, forming from one to one and one-half volutions; posterior side for some distance from apertural margin nearly straight. Spire laterally more or less compressed; sometimes small and short, sometimes long, attenuate, simply incurved or enrolled. Aperture oval, or sub-circular; margin sharp, sinuous. Surface marked by somewhat imbricated lines of growth, and several obscurely defined longitudinal plications, the anterior one being usually larger than the others, and often forming a prominent subangular ridge.

Horizon and localities.—Keokuk limestone and shales: Warsaw and Nauvoo, Illinois; Saint Louis limestone: Spurgeon Hill and Bloomington, Indiana; Tuscumbia, Alabama.

This form appears to have a geographically wide distribution; and it also presents considerable variation, even within limited areas. It was originally described from Spurgeon Hill, Indiana, and like all the faunal remains of that locality is characteristically depauperate. *Platyceras uncum* M. & W. seems to be identical with this species, the imposed conditions of environment being more favorable to a normal development, and to the attainment of somewhat larger proportions.

Orthonychia chesterense (MEEK & WORTHEN).

Plate liv, figs. 1a-d.

Platyceras (*Orthonychia*) *chesterense* Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 265.

Platyceras chesterense Keyes, 1888: Proc. Am. Philosophical Soc., vol. XXV, figs. 4-5.

Capulus chesterensis Keyes, 1890: American Geologist, vol. VI, p. 9.

Capulus chesterensis Keyes, 1890: Proc. Acad. Nat. Sci., Phila., p. 176, pl. ii, figs. 13a-d.

Shell quite small, obliquely conical, with usually five more or less well-defined longitudinal furrows, which alternate with broad, flattened folds.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Genevieve.

This little species is found almost invariably attached to the vaults of crinoids; and Meek & Worthen report one adhering to the side of *Pentremites godoni* DeFrance, "so as to entirely cover one of the pseudo-ambulacral fields and two intermediate areas." The specimens from Kentucky are nearly all attached to Pterotocrinus—*P. acutus, P. bifurcatus* and *P. depressus.* In the first of these species the ventral side is very much elevated, being nearly three times the height of the dorsal cup. The first radial dome-plates are produced into monstrous alate processes, leaving only a small summit, which is perforated for the anus. The margin of the gasteropod shell has followed closely the surface in contact; and in the majority of cases, when the apical part of the crinoidal vault was not sufficiently extensive for the support of the enlarging shell, the apertural margin has been prolonged into the interradial depressions, forming prominent, rounded, linguiform extensions; while the protruding upper edges of the alate dome-plates of the crinoid have given rise to five deep, broadly rounded sinuses in the lip of the molluscan shell. The lines of growth in the shell are therefore extremely sinuous, the undulations in the direction of the aperture being concave on the broad, flattened folds, and convex in the furrows. In some specimens the furrows and folds have their origin near the apex—a fact which is suggestive that the forms of the shell

and the configuration of the apertural margin may not be entirely dependent upon the immediate surface in contact; but from a long-continued habit of adhering to a crinoid presenting such remarkable ventral features as Pterotocrinus, the gasteropod gradually acquired, after many generations, a decided tendency toward the quinquelobate form, which made itself manifest at an early period of the mollusk's existence, and perhaps even in the latter part of the embryonic stage.

In order to bring the mouth over the ventral aperture of the crinoid, and at the same time rest securely on the limited, flattened, summit, at one side of which the anal opening was situated it was necessary for the gasteropod to have the anterior portion of the shell directed toward the posterior side of the crinoid —one of the few instances of the kind that have been noted; for almost invariably the front of the gasteropod shell is directed toward the anterior side of the echinoderm.

Genus Strophostylus Hall.

The group embraces a considerable number of familiar species, ranging in geologic time from the Niagara epoch to the close of the Paleozoic. It is rather unfortunate, therefore, that Conrad's term, Platystoma, had been preoccupied, having been used in generic diagnoses on at least four different occasions. Megerle early applied this name to certain mollusks closely related to Buccinum; but so far as is known, no formal publication of the term was ever made. Were this the only obstacle in the way, Conrad's genus might be allowed to stand, for the reason that Megerle's proposition was only in manuscript. Klein, however, proposed Platystoma in 1753 for a genus of Cyclostomacea. Meigen adopted the same term in 1803 for certain flies, and Agassiz, in 1829, also used it for a section of Silurid fishes. The preoccupation of Conrad's Platyostoma by Klein's Platystoma, like a number of similar cases, has been objected to on the ground that the two terms, while derived from the same words, are not identical, because Conrad's compound has a connecting o. It is quite manifest, however, that both generic words are taken from *platys* and

stoma; and that from these it was the intention of Conrad to construct a correct generic term. In this attempt he used by mistake the connecting o, which is necessary in forming compounds with many Greek words, but which in the present instance was not called for, since the term is formed directly without the intervention of a copulatory vowel. For these reasons Conrad's and Klein's proposals cannot be regarded as distinct.

Since it is clear, then, that Platystoma cannot be retained for the American group of Paleozoic gasteropods, some other term must be adopted. Fisher has taken advantage of the questionable validity of Conrad's name, and has recently proposed Diaphorostoma for the same group, with *Platystoma niagarensis* Hall for his type. This writer places Hall's Strophostylus as a subgenus under Diaphorostoma; while Zittel assigns Hall's section to a similar taxonomic rank, but under Platystoma. Had Conrad's type of Platystoma not been a form midway between the two extremes of a series forming the group, Fisher's name might be retained; but the type of Strophostylus is congeneric with *P. ventricosum*; and as this name was the next proposed, it must be taken into consideration. Were it not for this fact, two sections of this group of shells could be with great propriety made. As regards the term Strophostylus, it was established by Hall in 1859 for certain shells closely related to Platystoma, but differing chiefly in having a slightly "twisted or spirally grooved columella."

Recently a large series of the most important species of both Platystoma and Strophostylus was examined and the matrix carefully removed from the apertural portions of many of the shells. The structural features disclosed in the various forms show a relationship between the two established genera that was long suspected. It is well known that the type of Conrad's genus—*Platystoma ventricosum* Conrad—is a somewhat globose shell with a small spire elevated slightly, and having the aperture broadly ovate. The inner lip is somewhat thickened and subangular within, giving a slight indication of a col-

umella. In all respects it very closely resembles the typical forms of *Strophostylus cyclostomus* Hall, from the Niagara shales of Waldron, Indiana. The shells described under Platystoma subsequent to the appearance of the original diagnosis vary more or less from the typical species. The general tendency, however, has been to include under Conrad's genus those forms having a rather small, depressed spire, the inner lip rather thin, and simply reflected over the body-whorl. Often the lip does not touch the second volution, and the mouth of the shell is frequently free for a considerable distance. Some of these forms closely approach Paleozoic species of Capulus.

When, in 1859, Hall examined the interior of a Platystoma-like shell (which he afterward called *Strophostylus andrewsi*), he found that the specimen had the inner lip considerably thickened and somewhat angular within. As a matter of course, the interior angularity appeared twisted on account of the continued enlargement of the shell to the adult stage. In some individuals the thickening was considerably exaggerated, and formed a short projecting lamella or ridge. But from the figures given by Hall it is clear that this was not entirely characteristic, and the two specimens figured in the text differ widely in this particular. Nevertheless, Strophostylus was proposed, and has since been applied to nearly a score of species.

The limits of Conrad's and Hall's genera have never been precisely defined in the descriptions of species, and the larger majority of the forms in question have manifestly been assigned to their respective groups, more on account of the general shape of the shell than from an examination of the columella parts, which were only in exceptional cases visible without the removal of the hard matrix.

From the foregoing it is evident that Strophostylus and Platystoma are practically identical, and that, therefore, the two must be regarded as synonymous. The type of the first section, *Strophostylus andrewsi*, actually stands at one extremity of a rather extensive and variant series of shells, of which *Platystoma ventricosum* is one of the median members.

At the other extremity are the Capulus-like forms, similar to those described by White and Whitfield as *Platyceras bivolve*.

Strophostylus, as now understood, embraces three rather well-marked types of shells. One of these sections contains chiefly those extreme forms upon which the genus was originally founded. These shells are subglobose, with the spire somewhat elevated; the columella parts are prominent, and the front portion of the inner lip is considerably thickened, often having a distinct depression or groove, which continues inward around the columella. This group finds its greatest development in the Upper Silurian. Another section includes shells similar to *Strophostylus* (*Platystoma*) *niagarensis*, in which the spire is depressed, the inner lip simply anchylosed to the body-whorl, and thickened to little or no extent. These forms predominate in the Devonian. They closely approach certain Capuli, which have been called Platycerata, and it is very probable that the generic position of a number of species in the latter genus will be modified upon more critical examinations of all the forms. To the third section belong chiefly Carboniferous shells like *Strophostylus* (*Platystoma*) *peoriensis* McChesney.

Strophostylus reversus (Hall).

Platyceras reversum Hall, 1860: Geology Iowa, vol. I, Supp., p. 91.
Platyceras reversum Meek & Worthen, 1868: Geol. Sur. Illinois, vol. II, p. 508, pl. xv, figs. 4a–b.

Shell ventricose, subovate; volutions about two in number, rapidly increasing in size from the apex; spire very small, depressed, somewhat flattened; aperture large, subcircular in outline. Columella narrow, furrowed longitudinally. Surface marked only by lines of growth.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville (Cooper county).

As remarked in the Synopsis of American Carbonic Calyptræidæ, this form is not a member of the Capulus nor Platyceras group, but manifestly belongs to Strophostylus as now understood. Meek's discovery of a well-defined, grooved columellar thickening in the Boonville specimen adds further proof of its affinities to the genus just alluded to.

Strophostylus ? carleyana (HALL).

Natica carleyana Hall, 1856: Trans. Albany Inst., vol. IV, p. 31.
Naticopsis carleyana Miller, 1877: Cat. Am. Pal. Foss., p. 154.
Naticopsis carleyana Whitfield, 1882: Bul. American Mus. Nat. Hist, No. 3, p. 71, pl. viii, figs. 26-27.
Naticopsis carleyana Hall, 1883: Geol. Sur. Indiana, 12th Ann. Rept., p. 369, pl. xxxi, figs. 26-27.

A minute shell, consisting of about three whorls; and with inner lip greatly thickened.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Alton, Illinois.

Strophostylus nana MEEK & WORTHEN.

Platystoma nana Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 463.
Naticopsis nana Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 365, pl. xxxi, fig. 4.
Naticopsis nana White, 1884: Geol. Sur. Indiana, 13th. Ann. Rep., pt. ii, p. 162, pl. xxxvi, figs. 6-7.
Naticopsis nana Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 257.

Shell very small, globose, slightly wider than high; volutions three or four in number, increasing rapidly in size; body whorl very large and ventricose, spire low and small; suture deep. Aperture large, broadly ovate. Surface marked by fine lines of growth, which pass into small regularly arranged elevations near the suture.

Horizon and localities—Upper Carboniferous, Upper Coal Measures: Clinton (Henry county), Kansas City.

A recent examination of a good series of the form under consideration from Iowa, appears to indicate that the shell is not a true Naticopsis, as was thought by Meek & Worthen, and as is generally understood, but belongs more properly to Hall's genus Strophostylus as recently amended. As already stated in another place, it has been deemed advisable to modify somewhat the limits of Naticopsis, and apply the name only to those shells having a close resemblance to the typical species which, without exception so far as is known, have a more or less well-defined series of short, transverse ridges near the sutural line.

Strophostylus remex (WHITE).

Plate iv, figs. 7a-b.

Naticopsis remex White, 1876: Geol. Uinta Mts., p. 109.
Naticopsis remex White, 1883: U. S. Geol. and Geog. Sur. Terr., p. 139, pl. xxxiv, fig. 6.

Shell rather small, partially uncoiled toward the aperture; whorls about four in number, very convex; spire short. Aperture sub-circular; lip sharp. Surface smooth, or only marked by lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

The form under consideration is not of uncommon occurrence in western Missouri and eastern Kansas, and appears to be identical with the shell described by White as *Naticopsis remex*. Well-preserved shells show plainly that this species is a member of the group represented in the Coal Measures by *Platystoma peoriense* of McChesney and has none of the distinguishing characters of Naticopsis as at present understood. The last whorl is somewhat uncoiled, just as in certain Upper Silurian species from Waldron, Indiana.

Strophostylus peoriensis (MCCHESNEY).

Plate iii, fig. 6.

Platystoma peoriense McChesney, 1860: Desc. New Pal. Foss., p. 62.
Platystoma peoriense McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 49, pl. ii, figs. 11a–b.
Strophostylus peoriensis Keyes, 1890: Am. Naturalist, vol. XXIV, p. 115, pl. xxxiii, fig. 7.

Shell of medium size, thin, somewhat elongated; volutions about two in number, contiguous, enlarging rather rapidly, the outer one quite ventricose; spire depressed, scarcely rising above the general level of the whorls; suture rather deep, distinct. Aperture ovate. Surface glabrate, with very fine lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Genus Naticopsis McCoy.

The described species of Naticidæ from the American Paleozoic rocks number about three score. These have commonly been referred to the genera Naticopsis, Platystoma and Strophostylus. The first of these three terms was proposed in 1844 by McCoy, and included shells which had previously been assigned to the modern genus Natica. Seven species were enumerated under the new title; but of the accompanying figures only two showed the apertural characters. In America the shells of this group were first recognized by Norwood and Pratten, who described from the Coal Measures *Natica ventricosa*. Shortly afterward several other forms were detected and placed under the same genus. It was then found that McCoy's generic term was applicable to the American forms hitherto regarded as Naticæ; and still more recently it was discovered that in addition to the species generally recognized as belonging to Naticopsis, the genus should also include several other forms now known under other generic titles.

The species that have been referred to Naticopsis appear to form at least two, and possibly three, more or less well-defined groups. These sections differ so greatly in several important particulars that actually they should be regarded as generically distinct. Meek and Worthen, recognizing the fact, proposed to establish three subgenera; but their subdivisions were based upon surface ornamentation. The three sections were: Naticopsis proper, a group typified by *Nerita subcostata* Goldfuss, but not named; and Trachydomia, including *N. nodosa*, M. & W., *N. hollidayi* M. & W. and *Littorina wheeleri* Swallow; besides two European species. In Naticopsis proper, as represented by the typical forms, and by the majority of American species referred to the genus, the shells are relatively thin; the spire very short; the outer lip extremely thin and sharp; the inner lip also thin and slightly depressed; the last volutions generally more or less flattened or concave on the upper half, and marked toward the suture

by numerous small, short, equidistant costæ parallel to the lines of growth; the surface otherwise glabrate.

Naticopsis ventricosa (Norwood & Pratten).

Natica ventrica Norwood & Pratten, 1854: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 76, pl. ix, figs. 10a-b.

Naticopsis magister Stevens, 1858: Am. Jour. Sci., (2), vol. XXV, p. 261.

Naticopsis pricei Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 202.

Natica shumardi McChesney, 1860: Desc. New Pal. Foss., p. 62.

Natica altonensis McChesney, 1860: Desc. New Pal. Foss., p. 63.

Naticopsis shumardi McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 49.

Naticopsis altonensis McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 50, pl. ii, fig. 14.

Naticopsis ventricosa Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 592, pl. xxviii, figs. 13a-b.

Naticopsis altonensis Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 595, pl. xxviii, figs. 11a-b.

Naticopsis altonensis, var. *gigantea* Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, pl. xxviii, figs. 12a-b.

Shell ovoid; spire small, depressed; volutions two or three, the last one very large and ventricose, regularly rounded, except near the suture, where it is slightly flattened or concave. Suture deeply impressed toward the aperture, which is oval, compressed above; labrum sharp; columellar lip thick, smooth. Surface marked by fine lines of growth, which, near the suture, pass into small, well-defined, rounded ridges.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City, Clinton (Henry county).

Genus Trachydomia Meek & Worthen.

The term Trachydomia was originally proposed by Meek & Worthen in 1866, as a subgenus of Naticopsis McCoy. It is now believed that the characters are sufficiently well marked to admit of a distinct generic separation from McCoy's genus.

In contradistinction to Naticopsis the shells of Trachydomia are massive, with the spire larger and more elevated; the outer lip very thick, but abruptly becoming sharp; the columella very heavy, the callosity thick and greatly extended; the volutions shallowly channeled along the suture; and the surface covered with numerous small equidistant nodes. But two North American specimens—*Littorina wheeleri* Swallow

and *Naticopsis nodosa* Meek & Worthen—seem to be referable to Trachydomia; the other three forms described under the genus M. & W., *T. hollidayi* M. &. W., and *T. nodulosa* Worthen, being at present regarded merely as more mature individuals the first of *T. nodosa*, and the second of Swallow's species. A comparison of an extensive series shows that within certain limits the shells of this group are quite variable. The callosity in some specimens is much more extended than in others; while numerically the surface nodes vary greatly in different individuals, and become much larger and more widely separated as, with age, the shell increases in size.

Trachydomia wheeleri (Swallow).

Plate lv, fig. 8.

Littorina wheeleri Swallow, 1860: Trans. St. Louis Acad. Sci., vol. 1, p. 658.
Naticopsis (*Trachydomia*) *wheeleri* Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 364.
Naticopsis wheeleri Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 595, pl. xxviii, fig. 3.
Naticopsis wheeleri White, 1884: Geol. Sur. Indiana, Ann. Rep. 1883, pt. ii, p. 162, pl. xxxii, figs. 13–14.
Trachydomia nodulosa Worthen, 1884: Illinois State Mus. Nat. Hist., Bul. 2, p. 8.
Trachydomia wheeleri Keyes, 1889: Am. Geologist, vol. IV, p. 195.
Trachydomia wheeleri Keyes, 1890: The Nautilus, vol. IV, p. 30.
Trachydomia nodulosa Worthen, 1891: Geol. Sur. Illinois, vol. VIII, p. 146, pl xxiii, figs. 11–11a.
Trachydomia wheeleri Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 257.

Shell thick; whorls four or five; the spire rather elevated, aperture ovate, outer lip rapidly becoming attenuated; callosity of the inner labrum thick and greatly extended. Columella heavy. Surface covered by numerous regularly arranged tubercles.

Horizon and localities.—Upper Carboniferous, Coal Measures: Clinton (Henry county), Kansas City. Also Peoria, Springfield, Alton and elsewhere in Illinois; Des Moines, Iowa; and, according to White, in New Mexico.

The first species of this group described from the American Paleozoic rocks was brought to notice by Swallow under the name of *Littorina wheeleri*. Since the appearance of Swallow's description, three other similar shells have been given

specific titles: *T. nodosa* M. & W., which was regarded as the type of the genus; *T. hollidayi* M. & W. and *T. nodulosa* Worthen. Now the known shells of this type have a wide geographic distribution. A careful comparison of a considerable number of shells from widely separated localities leads to the conclusion that the described forms of Trachydomia should all be referred to only two species—the earliest noticed—*T. wheeleri* and *T. nodosa*. The various slight modifications in size and number of nodes are ascribed to local differences in environment; and the complete intergradation of the several forms renders this view necessary.

The callosity of the inner lip becomes very much thickened in some individuals, but this feature is not so conspicuous in the majority of examples. It is interesting to note in this connection that among the shells from Illinois there are a number in which the coloration of the callous portions and of the interior surface is still preserved. In some cases the color is an intense shining black; in some a purplish black; in others dull, faded purple, and in a few the color has nearly disappeared. Aside from the apertural parts all traces of the original coloration of the shell are lost. Under the ordinary circumstances of fossilization the primitive coloring could hardly be expected to be preserved, except in rare cases, and the few recorded instances of Paleozoic species retaining traces of the early color are of peculiar interest.

Trachydomia nodosum (Meek & Worthen).

Naticopsis nodosa Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p 463.

Naticopsis hollidayi Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 463.

Naticopsis nodosa Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 366, pl. xxxi, fig. 2.

Naticopsis nodosa, var. *hollidayi* Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 367, pl. xxxi, fig. 3.

Shell similar to *T. wheeleri*, but much larger, more massive, and with the nodes of greater size.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Aclisina?? bellilineata MILLER.

Aclisina bellilineata Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rept., Adv. sheets, p. 85, pl. xiv, fig. 10.

Horizon and localities.—Lower Carboniferous, Kinderhook limestone: Sedalia.

Aclisina minuta (STEVENS).

Aclis minuta Stevens, 1858: Am. Jour. Sci., (2), vol XXV, p. 259.
Murchisonia minima Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 203.
Aclisina minuta de Koninck, 1881: Ann. de Mus. Roy. d'Hist. Nat. de la Belgique, t. VI, p. 86.
Aclisina minuta Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 240.
Aclisina minuta Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 259.

Shell minute, turreted, composed of nine or more volutions. Whorls regularly convex; suture deeply impressed. Aperture subcircular. Surface ornamented by numerous fine revolving lines.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Lexington.

Aclisina stevensana (MEEK & WORTHEN).

Turritella stevensana Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 382, pl. xxvii, figs. 8-18a.

Shell much like *A. minuta,* but considerably larger, with fewer revolving lines of ornamentation.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Aclisina robusta (STEVENS).

Aclis robusta Stevens, 1858: Am. Jour, Sci., (2), vol. XXV, p. 259.
Aclis robusta Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 596, pl. xxix, figs. 6a-b.
Aclisina robusta Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p 240.

Like *A. minuta,* but much shorter, and with three or four volutions less.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Genus Bulimorpha WHITFIELD.

In addition to those species originally included Bulimorpha has recently been found to embrace several described forms long known under other generic titles. The group was first designated as Bulimella by Hall, but this name was preoccupied by Pfeiffer. Recognizing that Hall's name could not be retained, Meek and Worthen, who, in 1866, had just introduced Portlock's term Polyphemopsis into the literature of American Paleontology, referred to the genus the species described by Hall under Bulimella, and also three additional forms, originally placed with Loxonema and Eulima. A number of other American fossil gasteropods have from time to time been assigned to Portlock's genus. But Polyphemopsis was founded on very imperfect material, and its structural characters have never been sufficiently understood to definitely limit the group. It seems to be regarded by the majority of European writers as a synonym of Macrochilus Philips. The latter, however, has recently been shown to be identical with Soleniscus Meek and Worthen, which has precedence over Phillip's preoccupied term.

Although more than half a score of species have, in this country, been referred to the genus, it is quite apparent that members of at least two very different groups were included; while a detailed comparison of the various representatives appears to indicate that, with a few possible exceptions, no forms congeneric with Portlock's *Polyphemopsis elongata,* which may be regarded as the type of his genus, have as yet been recognized, with any degree of certainty, in the Paleozoic rocks of America. Until typical specimens of Polyphemopsis can be critically examined, the genus must be considered as of very doubtful utility.

As already stated, there were embraced in this group such species as constituted Hall's genus Bulimella. These, perhaps, best exemplify the American forms of the section under consideration. The shells are fusiform, with the spire elongated; the whorls more or less decidedly convex, the last rather large;

the columella curved, abbreviated or truncated at the base; the inner lip often well defined anteriorly, and usually separated from the outer by a more or less well-marked notch; surface smooth; accordingly, this group would include not only those forms originally comprehended under Bulimella, but also the species hereafter enumerated, and perhaps a few others now known under other generic titles.

Since then, it is manifest that Polyphemopsis is not correctly applicable to any known American gasteropods, and inasmuch as Bulimella of Hall had been used by Pfeiffer, it is necessary to find some more appropriate term to designate this group. Bulimorpha, established by Whitfield, is apparently the only available name for the shells in question, but whether this title will eventually be considered valid cannot now be decided.

Bulimorpha bulimiformis (Hall).

Bulimella bulimiformis Hall, 1858: Trans. Albany Inst., vol. IV, p. 29.
Polyphemopsis bulimiformis Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 373.
Bulimorpha bulimiformis Whitfield, 1882: Bul. Am. Mus. Nat. Hist., vol. I, p. 74.
Bulimorpha bulimiformis Hall, 1883: Geol. Sur. Indiana, Ann. Rept. for 1882, p. 366, pl. xxxi, figs. 37–39.
Bulimorpha bulimiformis Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 300.

Shell fusiform, with the spire occupying about half the entire length; volutions five to six, regularly convex, and increasing in size rather rapidly, the last somewhat longer than the spire. Aperture broadly lanceolate; outer lip sigmoidal, with a small notch anteriorly; columella somewhat bent and truncated at the base. Surface smooth, but often showing faint lines of growth.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Bulimorpha inornata (MEEK & WORTHEN).

Plate lv, fig. 6.

Loxonema inornata Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 465.

Polyphemopsis inornata Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 374, pl. xxxi, figs. 8a–c.

Bulimorpha inornata Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 301.

Shell rather robust; volutions about seven in number, slightly convex, the last rather large, occupying over half the entire length; suture slightly impressed. Aperture narrowly obovate, pointed above. Surface smooth, or showing only lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Eulima ? peracuta MEEK & WORTHEN.

Eulima peracuta Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 466.

Polyphemopsis peracuta Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 375, pl. xxxi, figs. 7a–b.

Polyphemopsis peracuta White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 163, pl. xxxii, figs. 9-10.

Polyphemopsis peracuta Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 302.

Shell elongate-conical; spire attenuate, acutely pointed at the apex. Whorls thirteen, nearly flat, increasing gradually in size, the last forming more than half the entire length, slightly prominent around the middle, somewhat extended below; suture moderately impressed. Aperture rather narrowly subovate, acutely angular above; inner lip somewhat reflexed below, and winding around the columella so as to pass out of sight opposite the middle of the aperture; columella arcuate and tortuous. Surface smooth.

Horizon and localities—Upper Carboniferous, Upper Coal Measures: Sullivan county.

Loxonema tenuilineatum (SHUMARD).

Chemnitzia tenuilineata Shumard, 1855: Geol. Sur. Missouri, Ann. Rept., p. 207, pl. C, fig. 12.

Loxonema tenuilineatum Miller, 1890: N. A. Geol. and Pal., p. 408.

Shell rather large, broad; volutions moderately convex; suture rather deeply impressed. Aperture subovate. Surface marked by numerous very fine, vertical costæ, which arch gently backward; crossing these are low obsolete revolving ridges, of which there are from twelve to fifteen on the body-whorl.

Horizon and localities—Lower Carboniferous, Chouteau limestone: Chouteau Springs (Cooper county).

Loxonema multicosta MEEK & WORTHEN.

Loxonema multicosta Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 378, pl. xxxi, figs. 12a–c.

Loxonema multicosta Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 260.

Shell small, conical. Volutions about seven in number, moderately convex, the last forming about one-third the entire length; suture well defined; aperture rounded, subrhombic. Surface marked by small, nearly straight vertical costæ, which number about thirty in the body-whorl.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Loxonema scitulum MEEK & WORTHEN.

Loxonema scitulum Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 464.

Loxonema rugosum Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 465.

Loxonema scitulum Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 377, pl. xxxi, figs. 10a–c.

Loxonema rugosum Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 378, pl. xxxi, figs. 11a-c.

Loxonema scitulum Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 259.

Shell very small, elongate, conical, rounded below; volutions about seven, slightly curved, increasing gradually in size; suture distinct, but slightly impressed. Aperture subovate, rather sharply angular above. Surface marked by prominent rounded folds, which taper at both ends to the sutures of the respective whorls. These rounded ridges number from fifteen

to twenty-five on the last volution, while there are from three to four less on each preceding turn.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

There have been described from the Coal Measures of the Mississippi basin, a number of forms similar to the one under consideration. At first glance the vertical costæ appear perfectly straight, instead of arched, as in the more typical shells of the genus. Upon a closer examination, however, these ribs are found to curve considerably. The relatively much larger size of the rounded ridges in this section of the genus, as compared with the Devonian forms, tends greatly to obscure the actual curvature.

The figures accompanying the reprint of the original description are somewhat misleading in at least one particular: that is, in having the costæ of the adjoining whorls arranged directly above one another. The statement is also made that such is the case. Closer observation clearly shows that the arrangement alluded to is more apparent than real; and that in reality the ridges of the different turns are set slightly behind those of the preceding volution. Instead, therefore, of forming perfectly straight though interrupted folds, running from the middle of the body-whorl to the apex of the shell, the long rounded elevations are more or less twisted spirally to the right.

The number of costæ varies with the size of the shell. Usually there are from three to four ribs less on each whorl than on the one immediately preceding. Thus, the eighth whorl may have from twenty to twenty-five or more rounded ridges, while the fourth has only a dozen or fourteen. Below the middle of the volutions the costæ rapidly diminish both in height and breadth, and are continued as minute hair-lines.

The aperture is oval in outline, slightly flattened on the inner side. The lip springs abruptly from the callous portion, instead of gradually blending with it at a low angle, but otherwise the shell possesses all the characteristics of the typical forms of Loxonema.

Genus Soleniscus Meek & Worthen.

It has long been known that under Macrochilus of Phillips there have been described a number of gasteropodous shells, which differ very essentially from the typical forms of the genus. It has even been intimated that this genus, as generally understood, may comprise, in reality, several more or less well-marked divisions of perhaps more than subgeneric value. In a recent note the differences between the various groups were briefly considered, and two well-defined sections made out. At the same time, it was shown that the typical forms of Phillips' genus were generically identical with those of Soleniscus of Meek and Worthen. The two genera, being co-extensive, were therefore synonymous. The first of the two terms was, however, preoccupied, and inasmuch as the several other titles proposed at various times for shells of the same group were unavailable, the generic term suggested by Meek and Worthen must necessarily be substituted.

In separating the genus from Macrochilus, the authors of Soleniscus emphasized certain structural features as being distinctive in their group, but these characters are now known to be present in the typical species of the genus first established. On account of being more or less obscured by the adhering matrix, the peculiarities in question appear to have been overlooked by most writers. The assumed absence, in the members of Phillips' genus, of these characters, and their existence in the shells that were under immediate consideration, were regarded as sufficiently good reasons for the generic separation of the two groups, and for the establishment of a new genus. A single species only was originally assigned to Soleniscus. Miller subsequently referred *Macrochilis hallianum* Geinitz to this genus. Shortly afterward, White described two congeneric forms from New Mexico, and also included several of the Macrochili. More recently, some additional species of Macrochilus were transferred to Soleniscus.

With two possible exceptions, the described species from America are confined to the Carboniferous, the majority occur-

ring in the Coal Measures. Some of the forms are widely distributed geographically, and a few have also a very considerable geologic range. A number of the now recognized species will probably prove to be identical with forms previously known, but these cannot be, with certainty, determined except by a direct comparison of the type specimens. The synonymy, however, of a portion of the Macrochili has been made out as indicated beyond.

As already suggested, the forms of this group appear to be easily separable into two sections—the first typified by *Macrochilus acutum* (Sowerby) and *Soleniscus typicus* Meek & Worthen; and the second having for its typical representative *Macrochilus ponderosum* Swallow. The shells of the first group are characterized by being more or less elongate or fusiform, with the spire elevated, acute; body-whorl forming about one-half the length of the shell; aperture subelliptic, or oval, acutely angular posteriorly; columella imperforate, provided with a conspicuous revolving fold or ridge, which, however, in the perfect specimen is often scarcely discernible exteriorly, but as it passes inward becomes more and more pronounced, and is often accompanied by a second though much less promident fold of similar character; test thick.

The columellar ridge is in most examples usually hidden more or less completely by the imbedding matrix filling the aperture. By the removal of the outer lip the twisted fold becomes more apparent. In a perfect specimen of *Solenscus newberryi* (Stevens), this ridge is scarcely defined at the aperture, but toward the interior of the shell it gradually assumes greater prominence, becoming very much elevated, very sharp, and bordered on each side by a broad rounded canal, the outer one of which is narrower and considerably deeper than the other. On the inner margin of the second furrow there is often developed an obtuse prominence, much less conspicuous than the first, and best defined a short distance from the apertural margin. From this point it soon becomes obsolete inwardly, and finally disappears altogether. In the majority of the forms

referred to Soleniscus, the fold on the columella presents essentially the same characters, and is generally well disclosed by breaking away the outer lip of the shell slightly. When the exterior wall of the last whorl is entirely removed, the interior features of the columella are still better exhibited and for a much greater distance.

As generally recognized, the Macrochilus group has a wide range in time, beginning, according to the species described, in the Silurian, and continuing to the present time. Some of the forms have unquestionably been erroneously assigned to the genus. The typical examples are for the most part from the Devonian and Carboniferous, and, although the group probably continued to flourish after the close of the Paleozoic, it is very doubtful whether the majority of the later forms can properly be regarded as congeneric. In Europe the group became greatly expanded during the later Devonian and Carboniferous, but in America it is almost wholly confined to the latter age—the other forms referred to the genus being, with perhaps two or three exceptions, referable to other groups.

Polyphemopsis of Portlock has commonly been considered synonymous with Macrochilus, but whether it can be regarded as identical with the group as now defined cannot, at present, be satisfactorily determined. Portlock's genus was founded upon such imperfect material as to hardly deserve recognition in any case, and it would probably simplify matters greatly to ignore the term altogether. There appear to be no good grounds for assigning any American gasteropods to Polyphemopsis. The species so referred have, in reality, other generic affinities.

Soleniscus cooperensis (Swallow).

Macrochilus cooperense Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 100.

A small species, having the spire occupying about one-half the entire length of the shell, and with very convex volutions.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Cooper county.

Soleniscus missouriensis (Swallow).

Macrochilus missouriensis Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 201.
Macrochilina missouriensis Miller, 1890: N. A. Geol. and Pal., p. 409.

Shell large, somewhat ventricose; spire elevated. Whorls seven or more in number, the last large, all quite convex; suture deep. Aperture long, ovate, lanceolate; columellar fold rather prominent. Surface smooth.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Kansas City.

Soleniscus paludinæformis (Hall).

Macrochilus paludinæformis Hall, 1858: Geology Iowa, vol. I, pt. ii, p. 719, pl. xxix, fig. 10.
Soleniscus (*Macrochilus*) *paludinæformis* White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., p. 154, pl. xxxiv, fig. 17.
Soleniscus paludinæformis Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 308.
Soleniscus paludinæformis Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 262.

Shell thin, rather broadly subfusiform, the spire forming about one-half the length; volutions six to ten in number, slightly convex, the body-whorl rather more ventricose than those of the spire; suture line moderately impressed; columellar fold and grooves well defined. Surface marked only by fine lines of growth.

Horizon and localities. — Upper Carboniferous, Upper Coal Measures: Kansas City.

Soleniscus gracilis (Cox).

Macrochilus gracile Cox, 1857: Geol. Sur. Kentucky, vol. III, p. 570, pl. viii, figs. 11-11a.
Macrochilus gracile Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 239.
Soleniscus gracilis Keyes, 1889: American Naturalist, vol. XXIII, p. 423.
Soleniscus gracilis Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 307.
Macrochilina gracilis Miller, 1890: N. A. Geol. and Pal., p. 409.
Soleniscus gracilis Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 262.

Shell small, like *S. brevis*, but more slender and with the spire much higher.

Horizon and localities.—Upper Carboniferous, Lower Coal Measures: Clinton (Henry county).

Soleniscus brevis (White).

Macrochilus ventricosum Hall, 1858: Geology Iowa, vol. I, p. 718. (Preoccupied by Goldfuss.)
Soleniscus brevis White 1881: Expl. and Sur. w. 100 Merid., Supp. to vol. III, p. xxviii.
Soleniscus brevis Keyes, 1889: Am. Naturalist, vol. XXIII, p. 323.
Soleniscus brevis Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 307.

Shell small, thin, with the spire acute, and occupying about one-third the entire length; volutions about seven in number, rather strongly convex, the last moderately ventricose; suture impressed, but not deeply; columellar ridge well-defined. Surface polished, with a few obscure lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City, Clinton (Henry county).

The form originally described, from the lower Coal Measures of Iowa, by Hall, as *Macrochilus ventricosum*, is a thin, rather delicate shell, having but little resemblance to the specimens usually passing under this name, which are, almost without exception, young individuals of larger and heavier species. It is not at all probable that Hall's form and *Soleniscus brevis*, described from New Mexico, are identical, as has been thought lately by White. In case, however, that they do prove to be the same, White's name has precedence over Hall's title, inasmuch as the latter term had long been preoccupied. Until, then, typical examples of each form can be carefully compared, it does not seem advisable to propose a new name for the form known as *M. ventricosum.* Besides, Cox has described a very similar shell from Kentucky, which has also been recognized in the Des Moines valley, near the place where Hall's species was originally found; so that it is possible that this term will have priority over all others for the form now under consideration.

Soleniscus newberryi (Stevens).

Loxonema newberryi Stevens, 1858: Am. Jour. Sci., (2). vol. XXV, p. 259.
Macrochilus newberryi Hall, 1858: Geol. Iowa, vol. I, p. 719, pl. xxix, fig. 1.
Soleniscus planus White, 1881: Expl. and Sur. w. 100 Merid., Supp. to vol. III, p. xxix, pl. iv, fig. 4.
Macrochilina newberryi de Konnick, 1881: Ann. de Mus. Roy. d'Hist. Nat. de la Belgique, t. VI, p. 36.

Soleniscus fusiformis White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 154, pl. xxxiv, figs. 1, 5. (Not Hall, 1858.)
Soleniscus newberryi White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 153, pl. xxxiv, figs. 7, 8.
Macrochilus newberryi Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 240.
Soleniscus newberryi Keyes, 1889: Am. Naturalist, vol. XXIII, p. 423, pl. xx, fig. 5.
Soleniscus newberryi Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 308.
Soleniscus newberryi Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 260.

Shell thick, fusiform; spire equaling half the length of the shell, with the apex somewhat attenuated. Volutions seven to nine in number, the body-whorl being only moderately ventricose; outer lip thin, inner lip more or less callous. Columella slightly bent, with an obtuse fold anteriorly, which becomes more angular as it passes inward, and has a deep, broad furrow behind it. In front of the fold, and between it and the front border of the aperture, there is a narrow concave space, or short canal. Surface glabrate, marked only by fine lines of growth.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Sphærodoma penguis (Winchell).

Macrochilus pengue Winchell, 1863: Proc. Acad. Nat. Sci., Phila., p. 21.
Sphærodoma penguis Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 296.
Macrochilina penguis Miller, 1890: N. A. Geol. and Pal., p. 409.

Shell similar to *Sph. ponderosa*, but smaller and more slender.

Horizon and localities.—Lower Carboniferous, Burlington limestone: Louisiana.

Sphærodoma ponderosa (Swallow).

Macrochilus ponderosum Swallow, 1858: Trans. St. Louis Acad. Sci., vol. II, p. 202.
Macrochilus texanum Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 204.
Soleniscus (?) ponderosus White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., p. 156, pl. xxxiv, figs. 1-2.
Soleniscus texanus White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 155, pl. xxxiv, figs. 13-14.
Sphærodoma texanus Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 306.
Sphærodoma ponderosum Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 306.

Shell large, heavy, subglobose, spire depressed; volutions six in number, rapidly increasing in size from the apex, last one very large and ventricose. Aperture ovate; outer lip abruptly becoming sharp. Columella smooth. Surface glabrate, with faint lines of growth.

Horizon and localities. — Upper Carboniferous, Coal Measures: Kansas City.

The form described by Shumard as *Macrochilus texanus* appears to be merely the immature shell of Swallow's *S. ponderosa.* In individuals of the former the fold on the columnella is quite pronounced, while in the latter species it is scarcely noticeable. By making away the body whorl, however, in *S. ponderosa*, the revolving fold is found to rapidly increase in size and prominence; while a comparison of a large series of this species, of all sizes, shows that the fold on the collumella is really much more pronounced in the younger individuals, which cannot be told from the ordinary *S. texana.*

Sphærodoma littonana (Hall).

Natica littonana Hall, 1858: Trans. Albany Inst., vol. IV, p. 30.
Naticopsis littonana Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 268.
Naticopsis littonana, var. *genevievensis* Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Phila., p. 268.
Macrochilus littonanum Whitfield, 1882: Bul. Am. Mus. Nat. Hist., vol. I, p. 73, pl. viii, fig. 28.
Macrochilus littonanum Hall, 1883: Geol. Sur. Indiana, 12th Ann. Rept., p. 369, pl. xxxi, fig. 28.
Sphærodoma littonana Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 305.
Macrochilina littonana Miller, 1890: N. A. Geol. and Pal., p. 409.

Shell very small, globose; spire of small size, somewhat elevated; volutions four, last one extremely large and ventricose. Aperture ovate. Surface showing only lines of growth.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Genevieve.

Sphærodoma medialis (Meek & Worthen).

Macrochilus spiratus Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 196. (Not McCoy, 1850.)

Macrochilus mediale Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 466.

Macrochilus pulchellum Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 467.

Macrochilus intercalare Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 467.

Macrochilus mediale Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 370, pl. xxxi, figs. 5a-b.

Macrochilus intercalare Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 371, pl. xxxi, figs. 6a-b.

Soleniscus medialis White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., pt. ii, p. 156, pl. xxxiv, figs. 15-16.

Sphærodoma medialis Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 306.

Sphærodoma medialis Keyes, 1891: Proc. Acad. Nat. Sci., Phila., p. 262.

Shell much like that of *Sph. ponderosa* (Swallow), but smaller, more slender, and with the spire more elevated.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City, Clinton.

Sphærodoma primogenia (Conrad).

Stylifer primogenia Conrad, 1835: Trans. Geol. Soc. Penna., vol. I, p. 267, pl. xii, fig. 2.

Fusus inhabilis Morton, 1836: Am. Jour. Sci., (1), vol. XXIX, p. 160.

Macrochilus inhabilis Norwood & Pratten, 1855: Jour. Acad. Nat. Sci., Phila., vol. III. p. 76, pl. ix, figs. 9a-b.

Macrochilus primogenium Hall, 1858: Geology Iowa, vol. I, p. 720, pl. xxix, fig. 11.

Soleniscus ? primogenius White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., p. 157, pl. xxxiv, fig. 3.

Sphærodoma primogenia Keyes, 1889: Proc. Acad. Nat. Sci., Phila., p. 306.

Similar to *Sph. ponderosa* (Swallow), but smaller, spire higher, volutions more rounded, suture more deeply impressed.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Subulites elongatus Conrad.

Subulites elongatus Conrad, 1842: Geol. Sur. New York, Emmons' Rep., p. 392, fig. 101.

Subulites elongatus Hall, 1843: Pal. New York, Vol. I, p. 182.

Shell subulate, composed of seven to eight volutions, which are only slightly convex; suture distinct. Aperture rather nar-

rowly lanceolate, and about one-third as long as the entire length of the shell. Surface glabrate.

Horizon and localities.—Lower Silurian, Trenton limestone: McCune (Pike county).

As remarked by Meek, it is almost impossible to distinguish, generically, between Subulites, Conrad, and Polyphomopsis, Portlock. But as Conrad's genus was proposed first, it makes little difference, insofar as the name is concerned, whether or not the two are synonymous. They are probably not. It must be admitted, however, that Conrad's term was unaccompanied by a description, but his figures give a much better idea of the kind of a shell he had under consideration than a large proportion of the early genera proposed without figures. It is extremely curious, and indeed unfortunate, that among the dozen or more species described from North America, there is not a single one that shows clearly the structural characters of the shell. The group, however, is evidently a good one, and can be used advantageously, notwithstanding its imperfections.

Doubtful Species.

Murchisonia ozarkensis Shumard, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 106. Magnesian limestone: Ozark county. Cast.

Bellerophon scissile Conrad, 1846: Proc. Acad. Nat. Sci., Phila., vol. II, p. 175. Kaskaskia limestone: Ste. Genevieve county.

Macrochilus blairi Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., Adv. sheets, p. 86, pl. xiv, figs. 5–6. Chouteau limestone: Sedalia.

Trochita carbonaria Meek & Worthen, 1866: Proc. Acad. Nat. Sci., Philadelphia, p. 270. Kaskaskia limestone: Ste. Genevieve county.

PTEROPODS.

Tentaculites incurvus SHUMARD.

Plate xxxv, fig. 8.

Tentaculites incurvus Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 195, pl. B, figs. 6a-b.

Shell very small, attenuated, curved, with prominent, sharp annulations extending to the tip; at the large extremity there are four, five to six rings in the space of an eighth of an inch, and the intervening spaces are about double the width; but near the tip the rings are much closer together, and there are from eighteen to twenty in the eighth of an inch; the whole number of rings amounts to thirty-five. The surface is covered with fine longitudinal striæ, which cross the rings, as well as the spaces. In well-preserved specimens very fine transverse striæ can be perceived. (Shumard.)

Horizon and localities.—Lower Silurian, Girardeau limestone: Cape Girardeau.

Conularia marionensis SWALLOW.

Conularia marionensis Swallow, 1860: Trans. St. Louis Acad. Sci., p. 656.

Like *C. missouriensis*, but with a greater number of transverse costæ, which are also granulated.

Horizon and localities.—Lower Carboniferous, Hannibal (Vermicular) shales (Kinderhook): Hannibal.

Conularia triplicata SWALLOW.

Conularia triplicata Swallow, 1860: Trans. St. Louis Acad. Sci., p. 657.

Small, with the costæ triple; one large median rib with a smaller one on each side.

Horizon and localities.—Lower Carboniferous, Hannibal shales (Kinderhook): Marion county.

Conularia osagensis SWALLOW.

Conularia osagensis Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 98.

A large form with narrow transeverse costæ.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville (Cooper county).

Conularia subcarbonaria MEEK & WORTHEN.

Conularia subcarbonaria Meek & Worthen, 1865: Proc. Acad. Nat. Sci., Phila., p. 253.

Conularia subcarbonaria Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 520, pl. xix, fig. 4a-c.

Another large form with very fine, crenulated costæ.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Wayland (Clark county).

Conularia missouriensis ? SWALLOW.

Plate xxxv, figs. 1a-b.

Conularia missouriensis Swallow, 1860: Trans. St. Louis Acad. Sci., p. 657.

Conularia missouriensis Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 541, pl. xxii, figs. 5a-b.

Very large, elongated, four-sided, pyramidal, with two opposite sides wider than the other two; cross-section rectangular. Angles at the four corners deeply furrowed longitudinally; sides without distinct median groove. Surface marked by sharp prominent transverse ribs, which are about half as wide as the rounded furrows between; these curve more or less toward the aperture.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis; Keokuk limestone: Warsaw (Illinois).

Conularia subulata HALL.

Conularia subulata Hall, 1856: Trans. Albany Inst., vol. IV, p. 32.

Conularia subulata Whitfield, 1882: Am. Mus. Nat. Hist., Bul. 3, p. 91, pl. viii, fig. 3.

Conularia subulata Hall, 1883: Geol. Sur. Indiana, 12th Ann. Rept., p. 372, pl. xxxi, fig. 3.

A small form with closely arranged ribs.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Conularia crustula White.

Plate xxxv, fig. 2.

Conularia crustula White, 1883: U. S. Geol. and Geog. Sur. Terr., 12th Ann. Rep., p. 170, pl. xlii, fig. 4.

Shell rather small, having the usual four-sided pyramidal form—the four sides being equal, and flat or nearly so near the apex, but slightly convex toward the aperture; the four angles distinctly furrowed, and a slender furrow also marks the median line of each side, which furrow is more distinct upon the cast of the interior than upon the exterior surface of the test. Surface marked by the numerous transverse, raised striæ, common to this genus, which arch gently forward from each of the four angles; the majority of the striæ are continuous across the median line of the sides, and also across the angle-furrows, in crossing which they bend slightly backward. (White.)

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

CHAPTER XIV.

CEPHALOPODS.

Phragmoceras missouriensis MILLER.

Phragmoceras missouriensis Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., p. 89, pl. xv, fig. 2.

Horizon and localities.—Lower Carboniferous, Chouteau limestone: Sedalia.

Gonioceras anceps HALL.

Gonioceras anceps Hall, 1847: Pal. New York, vol. 1, p. 54, pl. xiv, figs. 1a-d.

Horizon and localities.—Silurian, Trenton limestone: Ste. Genevieve county.

Endoceras elongatum? HALL.

Endoceras proteiforme, var. *elongatum* Hall, 1847: Pal. New York, vol. I, p. 216, pl. lii, figs. 1a-l.

Like Orthoceras in external appearance; very large, attaining a diameter of six or more inches and probably a length of more than ten feet.

Horizon and localities.—Lower Silurian, Trenton limestone: Auburn (Lincoln county).

Goniatites gorbyi MILLER.

Goniatites gorbyi Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., p. 90, pl. xv, fig. 1.

A large lenticular form, with smooth surface and deep lobes and saddles.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Sedalia (Pettis county).

Goniatites osagensis SWALLOW.

Goniatites osagensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 659.

Shell small, with regularly rounded volutions; umbilicus small.

Horizon and localities.—Lower Carboniferous, Chouteau limestone: Cooper county; Burlington limestone: Louisiana.

Goniatites planorbiformis SHUMARD.

Goniatites planorbiformis Shumard, 1855: Geol. Sur. Missouri, Ann. Rep., p. 208, pl. C, figs. 11a-b.

Shell minute, volutions about six in number, broad, regularly rounded; umbilicus very broad.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Goniatites politus SHUMARD.

Goniatites politus Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 199.

A very small, compressed form, with volutions embracing and showing only the outer whorl. Surface highly polished.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Lexington.

Goniatites minimus SHUMARD.

Goniatites minimus Shumard, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 200.

A very minute shell, similar to *G. politus* but much more robust.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Dover landing (Lafayette county), Kansas City.

Nautilus? burlingtonensis (OWEN).

Gyroceras burlingtonensis Owen, 1852: Geol. Sur. Wisconsin, Iowa and Minnesota, p. 581, tab. v, fig. 10.
Nautilus burlingtonensis Miller, 1883: Cat. Am. Pal. Foss., p. 307.
? *Solenochilus blairi* Miller, 1892: Geol. Sur. Indiana, 18th Ann. Rep., p. 75, pl. xii, fig. 2.

A large robust form with rapidly increasing whorls, and gently curving suture lines.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Sedalia.

Nautilus digonus MEEK & WORTHEN.

Nautilus digonus Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II ~~III~~, p. 458, pl. xiv, figs. 9a–d.

A small form, with slender volutions, marked by longitudinal ribs and transverse lines.

Horizon and localities.—Lower Carboniferous, Kinderhook beds: Callaway county.

Nautilus spectabilis MEEK & WORTHEN.

Nautilus spectabilis Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila.; p. 469.

Nautilus peramplus Meek & Worthen, 1865: Proc. Acad. Nat. Sci., Phila., p. 259.

Nautilus spectabilis Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 308, pl. xxv, figs. 1a–b.

A large, robust form with smooth, rounded whorls.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: St. Louis county (Hambach).

Nautilus ponderosus WHITE.

Nautilus ponderosus White, 1872: U. S. Geol. Sur. Nebraska (Meek's report), p. 236, pl. iii, figs. 7a–b.

Shell attaining a large size, subdiscoidal; umbilicus large, or nearly equaling the dorso-ventral diameter of the outer volution near the aperture; volutions three, enlarging their diameter more than three-fold each turn; all broader transversely than dorso-ventrally; inner ones slightly embracing, while the last one is apparently merely in contact with the others near the aperture; each broadly flattened or a little concave on the periphery, and (particularly the last one) somewhat flattened between the periphery and the middle of each side, from which point the sides are broadly rounded into the umbilicus, the greatest transverse diameter being near the middle; ventrolateral or outer angles of the last whorl (in somewhat worn casts), each provided with obscure traces of about twenty wide, undefined nodes, scarcely perceptible to the eye; septa numerous, rather closely arranged, making a slight backward

curve on each side, particularly between the middle and outer angles, and crossing the broadly flattened dorsum with a strong backward curve; surface with distinct lines of growth, which curve strongly backward like the septa, in crossing the outer side. (Meek.)

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Nautilus winslowi Meek & Worthen

Plate lvi, fig. 2.

Nautilus winslowi Meek & Worthen, 1870: Proc. Acad. Nat. Sci., Phila., p. 50.
Nautilus (*Tremnochilus*) *winslowi* Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 609, pl. xxxii, figs. 2a-b.
Nautilus winslowi White, 1884: Geol. Sur. Indiana, 13th Ann. Rept., pt. ii, p. 165, pl. xxxvi, figs. 1-2.
Nautilus winslowi Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 242.

A large robust form, with broad umbilicus and flattened periphery, toward the margins of which on each side is a row of prominent tubercles.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Lexington (Lafayette county.)

Nautilus forbesianus McChesney.

Plate lvi, figs. 4a-b.

Nautilus forbesianus McChesney, 1860: Desc. New Pal. Foss., p. 63.
Nautilus forbesianus McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 50, pl. iii, fig. 4.
Nautilus forbesianus White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 165, pl. xxxvi, figs. 3-4.
Tremnochilus forbesianus Hyatt, 1891: Geol. Sur. Texas, 2nd Ann. Rep., p. 330.

Shell rather small, heavy; volutions rounded, with a series of prominent, distant nodes on each side toward the periphero-lateral border.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Nautilus occidentalis SWALLOW.

Nautilus occidentalis Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 196.
Nautilus quadrangularis McChesney, 1860: Desc. New Pal. Foss., p. 65.
Nautilus nodocarinatus McChesney, 1860: Desc. New Pal. Foss., p. 66.
Nautilus biserialis Hall, 1860: Geology Iowa, vol. I, Supp., p. 92.
Nautilus occidentalis McChesney, 1867: Trans. Chicago Acad. Sci., vol. I, p. 37.
Nautilus occidentalis Keyes, 1888: Proc. Acad. Nat. Sci., Phila., p. 342.

Shell rather above medium size, discoidal, with moderately wide, shallow umbilicus, in which is exposed nearly all of each of the inner whorls. Cross-section subquadrangular in outline, nearly flat dorsally and laterally, slightly concave ventrally. Nodes in six rows—one row on each side around the umbilicus, composed of small, depressed tubercles; a second series on each lateral angle of the periphery, of large prominent nodes; and the third, a double series around the periphery.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Nautilus missouriensis SWALLOW.

Plate lvi, fig. 3.

Nautilus missouriensis Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 198.

A small, smooth shell, probably an immature specimen of some other species.

Horizon and localities—Upper Carboniferous, Lower Coal Measures: Boone county.

Metacoceras cavatiforme (HYATT).

Metacoceras cavatiforme Hyatt, 1891: Geol. Sur. Texas, 2nd Ann. Rep., p. 334, figs. 30–33.
Metacoceras cavatiforme Miller, 1892: Geol. Sur. Indiana, 18th Ann. Rep., p. 72, pl. xi, figs. 5 and 7.

Shell medium size, of the *N. sangamonense* type, with a single row of nodes on each of the peripheral border.

Horizon and localities—Upper Carboniferous. Upper Coal Measures: Kansas City.

Metaceras sangamonense (Meek & Worthen).

Nautilus (Discus) sangamonensis Meek & Worthen, 1860: Proc. Acad. Nat. Sci., Phila., p. 470.

Nautilus sangamonensis Meek & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 386, pl. xxix, figs. 3-3b.

Metaceras sangamonense Hyatt, 1884: Proc. Boston Soc. Nat. Hist., vol. XXII, p. 208.

Shell like that of *N. occidentalis* but less robust, the nodes also being less prominent, and the peripheral rows absent.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Lituites? complanatus Shumard.

Lituites complanata Shumard, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 107.

Shell small, depressed, discoidal; sides very gently convex; volutions about four, not embracing, sloping from the ventral to the dorsal, which latter is subangulated; transverse section ovate; siphuncle small, dorsal; septa thin, concave, those of the last volution near the outer chamber scarcely more than one-half the width of those of the inner volutions. No surface markings are visible on any of the specimens under examination. (Shumard.)

Horizon and localities—Cambrian? magnesian limestone series: Ozark county.

Orthoceras chouteauense Swallow.

Orthoceras chouteauense Swallow, 1860: Trans. St. Louis Acad. Sci., vol. 1, p. 660.

A small form, tapering moderately; septæ distant.

Horizon and localities.—Lower Carboniferous, Chouteau (Kinderhook) limestone: Cooper county, Louisiana (Pike county).

Orthoceras chesterense Swallow.

Orthoceras chesterense Swallow, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 98.

A rapidly tapering form, with moderately distant septæ.

Horizon and localities.—Lower Carboniferous, Kaskaskia limestone: Ste. Mary (Ste. Genevieve county).

Orthoceras rushense McChesney.

Plate lvi, fig. 6.

Orthoceras rushensis McChesney, 1860: New Pal. Foss., p. 68.
Orthoceras rushensis Meek & Worthen, 1873: Geol. Sur. Illinois, vol. V, p. 612, pl. xxx, fig. 4.
Orthoceras rushensis White, 1884: Geol. Sur. Indiana, 13th Ann. Rep., pt. ii, p. 164, pl. xxxvi, fig. 5.
Orthoceras rushensis Keyes, 1888: Proc. Acad. Nat. Sci., Phila, p. 242.
Orthoceras harii Miller, 1891: Geol. Sur. Indiana, 17th Ann. Rep., p. 87, pl. xvi, fig. 2.

A small, slender form, with smooth surface.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Orthoceras occidentale Swallow.

Orthoceras occidentale Swallow, 1858: Trans. St. Louis Acad. Sci., vol. I, p. 201.
Orthoceras colletti Miller, 1892: Geol. Sur. Indiana, 18th Ann. Rep., p. 67, pl. x, fig. 1.

A rather large form, often attaining a length of two feet or more, gradually tapering; septæ quite concave; siphuncle eccentric.

Horizon and localities.—Upper Carboniferous, Upper Coal Measures: Kansas City.

Orthoceras ozarkensis Shumard.

Orthoceras ozarkensis Shumard, 1863: Trans. St. Louis Acad. Sci., vol. II, p. 107.

Shell elongate, very gradually tapering to the apex; septæ very thin, deeply concave, from nine to ten in the space of a quarter of an inch; external edge plane, and slightly sinuous; siphuncle marginal, transverse section reniform. Surface marked by annulations, oblique to the axis, the grooves between accommodating the edges of the septæ. In some specimens the surface of the shell is marked with faint longitudinal striæ. (Shumard.)

Horizon and localities.—Cambrian? Magnesian limestone: Ozark county.

Orthoceras arcuoliratum Hall.

Orthoceras arcuoliratum Hall, 1847: Pal. New York, vol. I, p. 198.

A rather small species, cylindrical, with slightly raised undulatory ridges running obliquely around the shell, and finely lined in a longitudinal direction.

Horizon and localities. — Silurian, Trenton limestone: Louisiana.

Orthoceras jolietense Meek & Worthen.

Orthoceras jolietense Meek & Worthen, 1865: Proc. Acad. Nat. Sci., Phila., p. 256.

Orthoceras jolietense Meek & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 465, pl. xxvi, fig. 5.

Shell large, very long and slender, tapering rapidly, and with the septæ very distant. Cross-section elliptic.

Horizon and localities.—Silurian, Niagara limestone: Grafton (Illinois).

Orthoceras medullare Hall.

Orthoceras medullare Hall, 1860: Geol. Sur. Wisconsin, Rept. Progress, p. 4.

Orthoceras striælineatum McChesney, 1861: New Pal. Foss., p. 94.

Orthoceras medullare Hall, 1867: New York State Cab. Nat. Hist., 20th Reg. Rep., p. 412, pl. xx, figs. 1-2.

Orthoceras medullare Meek & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 504, pl. xxvi, fig. 1.

Shell large, tapering gradually. Surface marked by prominent longitudinal ribs, crossed at regular intervals by transverse carinæ, giving a beautifully cancellated effect.

Horizon and localities.— Silurian, Niagara dolomite: Grafton (Illinois).

Spurious and Doubtful Species.

Goniatites holmesi Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 659. Kinderhook limestone: Cooper county. Cannot be recognized.

Goniatites morganensis Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 659. Kinderhook. Not recognizable.

Nautilus (Cryptoceras) capax Meek & Worthen, 1865: Proc. Acad. Nat. Sci., Phila., p, 262. Coal Measures: Charboniere. Name preoccupied.

Nautilus gilpini Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 658. Coal Measures: Wayne county. Too imperfect for recognition.

Nautilus lawsi Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 658. Devonian limestone: Callaway county. Poorly defined.

Orthoceras chemungense Swallow, 1860: Trans. St. Louis Acad. Sci., vol. I, p. 660. Lithographic limestone: Marion county. Not recognizable.

Poterioceras missouriensis Miller, 1892: Geol. Sur. Indiana, 18th Ann. Rep., adv. sheets, p. 70, pl. xi, fig. 6. Probably a Phagmoceras, and in that case the specific name is preoccupied. This original specimen is an internal cast, and too imperfect to refer with certainty to its proper genus.

CHAPTER XV.

VERTEBRATES.

Cladodus elegans Newberry & Worthen.

Cladodus elegans Newberry & Worthen, 1870: Geol. Sur. Illinois, vol. IV, p. 354, pl. iv, figs. 6-6a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Cladodus ischypus Newberry & Worthen.

Cladodus ischypus Newberry & Worthen, 1870: Geol. Sur. Illinois, vol. IV, p. 354, pl. iv, figs. 6-6a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Cladodus eccentricus St. John & Worthen.

Clododus eccentricus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 262, pl. iv, figs. 4a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Cladodus euglyphens St. John & Worthen.

Cladodus euglyphens St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 274, pl. iv, figs. 1a-b.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Lambdodus costatus St. John & Worthen.

Lambdodus costatus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 280, pl. v, figs. 3a-c.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville.

Lambdodus calceolus St. John & Worthen.

Lambdodus calceolus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 281, pl. v, figs. 5a-c.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: LaGrange (Lewis county).

Desmiodus? flabellum St. John & Worthen.

Desmiodus? flabellum St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 334, pl. xA, figs. 15a-c.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Boonville.

Desmiodus? ligoniformis St. John & Worthen.

Desmiodus? ligoniformis St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 342, pl. xA, figs. 12a-c.

Horizon and localities—Lower Carboniferous, Keokuk limestone: Boonville.

Desmiodus costelliferus St. John & Worthen.

Desmiodus costelliferus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 341, pl. xA, figs. 10a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Desmiodus tumidus St. John & Worthen.

Desmiodus tumidus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 339, pl. xA, figs. 7a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Venustodus tenuicristatus St. John & Worthen.

Venustodus tenuicristatus St. John & Worthen, 1875: Geol. Sur Illinois, vol. IV, p. 348, pl. ix, figs. 19a-c.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: St. Francisville (Clark county), Boonville (Cooper county).

Harpacodus occidentalis St. John & Worthen.

Harpacodus occidentalis St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 355, pl. xA, figs. 2a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Chomatodus parallelus St. John & Worthen.

Chomatodus parallelus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 359, pl. xA, figs. 3a-c.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville (Cooper county).

Chomatodus incrassatus St. John & Worthen.

Chomatodus incrassatus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 359, pl. x, figs. 18a-c.

Horizon and localities—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Lisgodus curtus St. John & Worthen.

Lisgodus curtus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 364, pl. xA, fig. 20a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville.

Lisgodus selluliformis St. John & Worthen.

Lisgodus selluliformis St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 366, pl xA, figs. 6a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Tanaodus prænuntius St. John & Worthen.

Tanaodus prœnuntius St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 371, pl. xi, figs. 6a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Tanaodus sculptus St. John & Worthen.

Tanaodus sculptus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 373, pl. xi, figs. 20a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Polyrhizodus williamsi St. John & Worthen.

Polyrhizodus williamsi St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 384, pl. x A, figs. 23a–b.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville.

Polyrhizodus littoni Newberry & Worthen.

Polyrhizodus littoni Newberry & Worthen 1870: Geol. Sur. Illinois, vol. IV, p. 596, pl. iii, figs. 16–16a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Polyrhizodus amplus St. John & Worthen.

Polyrhizodus amplus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 387, pl. xiii, figs. 13a–c.

Horizon and localities—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Petalorhynchus distortus St. John & Worthen.

Petalorhynchus distortus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 406, pl. xii, figs. 7a–c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Petalorhynchus pseudosagittatus St. John & Worthen.

Petalorhynchus pseudosagittatus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 405, pl. xii, figs. 1a–c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Peltodus quadratus St. John & Worthen.

Peltodus quadratus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 410, pl. xiii, figs. 6a–b.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Psephodus latus St. John & Worthen.

Psephodus latus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 72, pl. ii, figs. 1a–d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Vaticinodus? simplex St. John & Worthen.

Vaticinodus? simplex St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 84, pl. iv, figs. 22a-b.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Deltoptychius wachsmuthi St. John & Worthen.

Deltoptychius wachsmuthi St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 93, pl. v, figs. 1a-c.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville (Cooper county).

Deltoptychius expansus St. John & Worthen.

Deltoptychius expansus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 98, pl. v, fig. 9a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Stenopterodus parvulus St. John & Worthen.

Stenopterodus parvulus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 107, pl. iv, fig. 4a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Cochliodus obliquus St. John & Worthen.

Cochliodus obliquus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 126, pl. vii, figs. 17a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Cochliodus vanhornii St. John & Worthen.

Cochliodus vanhornii St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 120, pl. vii, figs. 1a-e.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Xystrodus imitatus St. John & Worthen.

Xystrodus imitatus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 180, pl. viii, figs. 2a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Sandalodus lævissimus (NEWBERRY & WORTHEN).

Sandalodus lævissimus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 104, pl. x, figs. 6, 7 and 8.
Sandalodus grandis Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 105, pl. x, fig. 9.
Deltodus grandis Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 101, pl. ix, figs. 9, 9a.
Cochliodus ? crassus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 186, pl. viii, figs. 2, 2a.
Psammodus ? semi-cylindricus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 109, pl. xi, figs. 4, 4a.
Psammodus ? rhomboideus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 110, pl. xi, figs. 6, 6a.
Sandalodus lævissimus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 186, pl. xii, figs. 8a–f.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville.

Sandalodus spatulatus NEWBERRY & WORTHEN.

Sandalodus spatulatus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 103, pl. x, fig. 2.
Deltodus rhomboideus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 100, pl. ix, fig. 8.
Sandalodus crassus Newberry & Worthen, 1870: Geol. Sur. Illinois, vol. IV, p. 369, pl. iv, fig. 3.
Sandalodus spatulatus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 188, pl. xii, figs. 7a–f.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Sandalodus crassus NEWBERRY & WORTHEN.

Sandalodus crassus Newberry & Worthen, 1870: Geol. Sur. Illinois, vol. IV, p. 369, pl. iv, figs. 3-3a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Orthopleurodus carbonarius (NEWBERRY & WORTHEN).

Sandalodus carbonarius Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 104, pl. x, figs. 4, 5.
Deltodus angularis Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 104, pl. ix, figs. 4, 5.
Orthopleurodus carbonarius St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 192, pl. xiii. fig. 6a.

Horizon and localities —Upper Carboniferous, Upper Coal Measures: Kansas City ?

Pœcilodus sancti-ludovici St. John & Worthen.

Pœcilodus sancti-ludovici St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 132, pl. viii, fig. 8a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint. Louis.

Deltodus littoni Newberry & Worthen.

Deltodus littoni Newberry & Worthen, 1870: Geol. Sur. Illinois, vol. IV, p. 367, pl. iv, figs. 8-8a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boone county.

Deltodus cinctulus St. John & Worthen.

Deltodus cinctulus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 146, pl. ix, figs. 6a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Barrett (St. Louis county).

Deltodus parvus St. John & Worthen.

Deltodus parvus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 150, pl. ix, figs. 1a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone, Saint Louis.

Deltodopsis sancti-ludovici St. John & Worthen.

Deltodopsis sancti-ludovici St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII,p. 161, pl. xi, figs. 2a-e.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Psammodus plenus St. John & Worthen.

Psammodus plenus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 213, pl. xvii, figs. 1a-f.

Horizon and localities —Lower Carboniferous, Saint Louis limestone: Saint Louis.

Copodus vanhornii St. John & Worthen.

Copodus vanhornii St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 229, pl. xx, figs. 2a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Ctenacanthus excavatus ST. JOHN & WORTHEN.

Ctenacanthus excavatus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 428, pl. xv, figs. 4a-d.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: LaGrange (Lewis county).

Ctenacanthus keokuk ST. JOHN & WORTHEN.

Ctenacanthus keokuk St. John and Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 427, pl. xv, figs. 8a-e.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville (Cooper county), LaGrange (Lewis county).

Ctenacanthus pugiunculus ST. JOHN & WORTHEN.

Ctenacanthus pugiunculus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 430, pl. xxi, figs. 9a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Ctenacanthus gracillimus NEWBERRY & WORTHEN.

Ctenacanthus gracillimus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 126, pl. xiii, fig. 3.

Leptacanthus ? occidentalis Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 116, pl. xii, fig. 2.

Acondylacanthus occidentalis St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 433.

Ctenacanthus gracillimus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 238, pl. xxiv, fig. 1a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Asteroptychius sancti-ludovici ST. JOHN & WORTHEN.

Asteroptychius sancti-ludovici St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 437, pl. xvi, figs. 3a-e.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: St. Louis.

Geisacanthus stellatus ST. JOHN & WORTHEN.

Geisacanthus stellatus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 440, pl. xxi, figs. 10a-e.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Plysonemus parvulus St. John & Worthen.

Plysonemus parvulus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 453, pl. xviii, fig. 11a.

Horizon and localities. — Lower Carboniferous, Keokuk limestone: Boonville (Cooper county).

Drepanacanthus reversus St. John & Worthen.

Drepanacanthus reversus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 456, pl. xix, figs. 5, 6.

Drepanucanthus reversus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 253, pl. xxiv, fig. 5a.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Erismacanthus maccoyanus St. John & Worthen.

Erismacanthus macoyanus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 461, pl. xxii, figs. 1a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Amacanthus gibbosus (Newberry & Worthen).

Homacanthus gibbosus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 113, pl. xii, fig. 1.

Amacanthus gibbosus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 464, pl. xxii, figs. 6a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Marracanthus rectus (Newberry & Worthen).

Homacanthus? rectus Newberry & Worthen, 1866: Geol. Sur. Illinois, vol. II, p. 115, pl. xii, fig. 6.

Marracanthus rectus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 466, pl. xxii, figs. 7a-k.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Physonemus falcatus St. John & Worthen.

Physonemus falcatus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 252, pl. xxiv, figs. 6a-b.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Batacanthus baculiformis ST. JOHN & WORTHEN.

Batacanthus baculiformis St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 469, pl. xxi, figs. 4a-f.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: LaGrange (Lewis county), St. Francisville (Clark county.)

Oracanthus vetustus LEIDY.

Oracanthus vetustus Leidy, 1856: Jour. Acad. Nat. Sci., Phila., (2), vol. III, p. 161, pl. 16, figs. 1, 2, 3.
Oracanthus consimilis St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 476, pl. xxii, fig. 15a-d.
Oracanthus vetustus St. John & Worthen, 1883: Geol. Sur. Illinois, vol. VII, p. 255, pl. xxix, figs. 2a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Gampsacanthus latus ST. JOHN & WORTHEN.

Gampsacanthus? latus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 474, pl. xxii, figs. 14a.

Horizon and localities.—Lower Carboniferous, Keokuk limestone: Boonville (Cooper county.)

Gampsacanthus squamosus ST. JOHN & WORTHEN.

Gampsacanthus squamosus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VII, p. 473, pl. xxii, figs. 13a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Gampsacanthus typus ST. JOHN & WORTHEN.

Gampsacanthus typus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 472, pl. xxii, figs. 12a-d.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Lecracanthus unguiculus ST. JOHN & WORTHEN.

Lecracanthus unguiculus St. John & Worthen, 1875: Geol. Sur. Illinois, vol. VI, p. 476, pl. xxii, figs. 10a-c.

Horizon and localities.—Lower Carboniferous, Saint Louis limestone: Saint Louis.

Vertebrate Tracks.

Beside the remains of hard parts of vertebrates mentioned, it is of great interest to note the recent discovery of large numbers of vertebrate tracks in the shaly sandstones of the Upper Coal Measures at Kansas City. Quite a variety are represented. Most of them are small, none over three or four inches across, and the greater part of them not over a couple of inches in transverse measurement. In all respects they are very similar to the Connecticut valley tracks, only smaller. Full mention will be made of these footprints in another place.

Synonymic Indexical List of the Fossils of Missouri.

BY CHARLES R. KEYES.

In the preparation of an index to the fossils of Missouri, it is the intention to put in form for ready reference a compact list of not only the valid species which have been found within the limits of the State, but also a list of the different names which have been, at various times, proposed for forms which are now known to belong to species previously described. In this way, all the fossils which have been reported from the region, no matter what name or names may have been assumed, may be referred to without difficulty under their proper titles. At the same time, the page is given where each species is considered in the report on the Paleontology of Missouri, where also additional references are given for an exhaustive study of the particular forms. The index, therefore, may be regarded as a systematic arrangement of all the terms which have been applied to the fossils occurring in Missouri. At the same time, it serves as a check-list for cataloguing purposes.

PLATE XXXIII.

Explanation of Plate XXXIII.

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	A large example. (Cox collection.)	
	Carboniferous, Keokuk limestone.	
Fig. 2.	*Archimedes owenanus*	26
	A typical specimen. (Mus. Mo. Geol. Sur.)	
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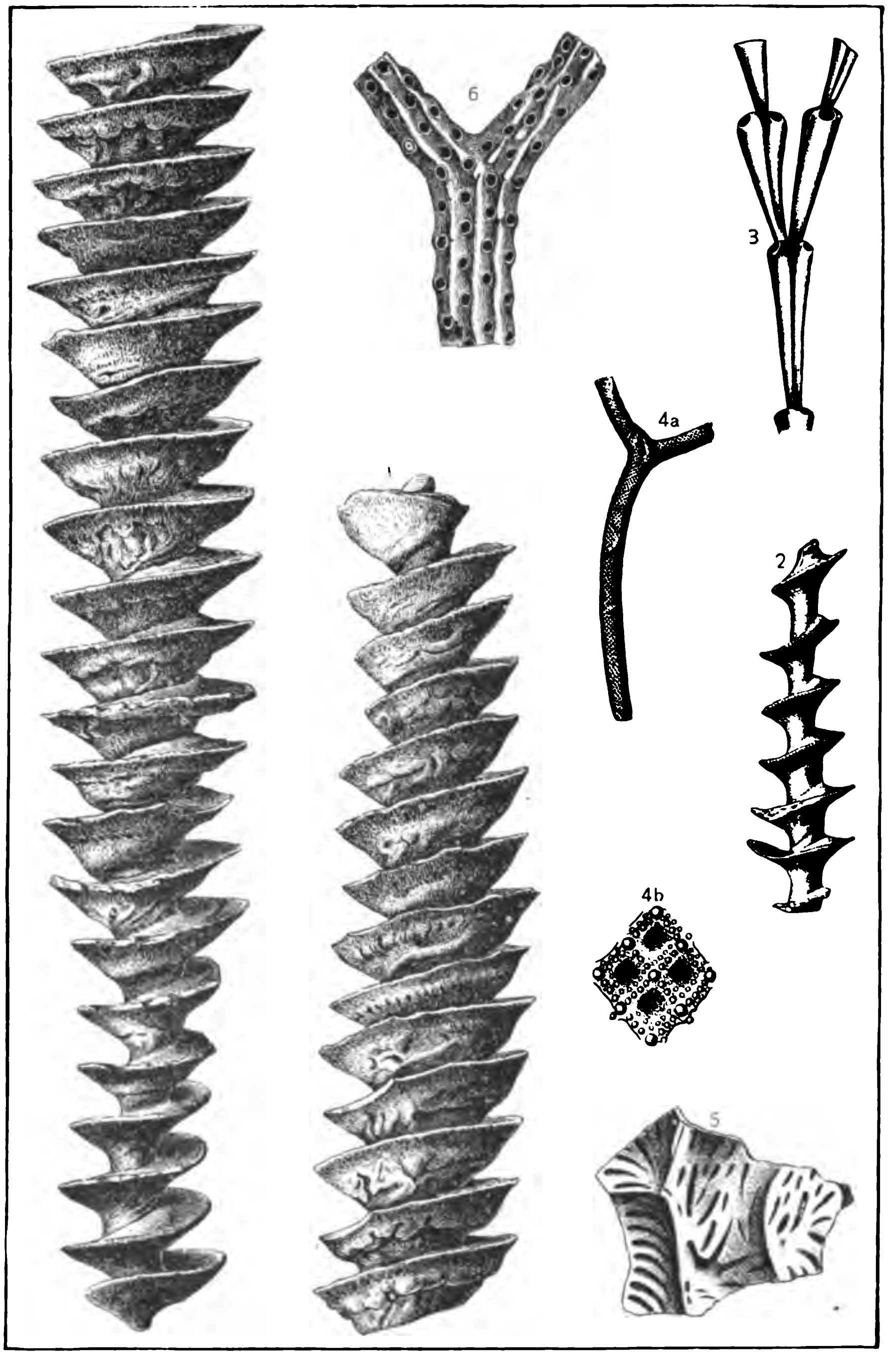
Fig. 3.	*Phacelopora pertenuis*	18
	Part of a zoarium. (After Ulrich.)	
	Silurian, Trenton limestone.	
Fig. 4.	*Rhombopora lepidodendroides*	35
4a.	A large example. (Hare collection.)	
4b.	Surface. (Enlarged)	
	Carboniferous, Upper Coal Measures.	
Fig. 5.	*Glyptopora plumosa*	20
	Fragment. (After Ulrich.)	
	Carboniferous, St. Louis limestone.	
Fig. 6.	*Thamniscus furcillatus*	31
	Fragment. (Enlarged, after Ulrich.)	
	Carboniferous, Kaskaskia limestone.	



POLYZOANS.

PLATE XXXIV.

EXPLANATION OF PLATE XXXIV.

Page.

FIG. 1. *Setopora biserialis* 32
1a. Non-poriferous side. (Hare collection.)
1b. A part of same (enlarged).
1c. Poriferous side (enlarged).
1d. Another specimen. (Hare collection.)
Carboniferous, Upper Coal Measures.

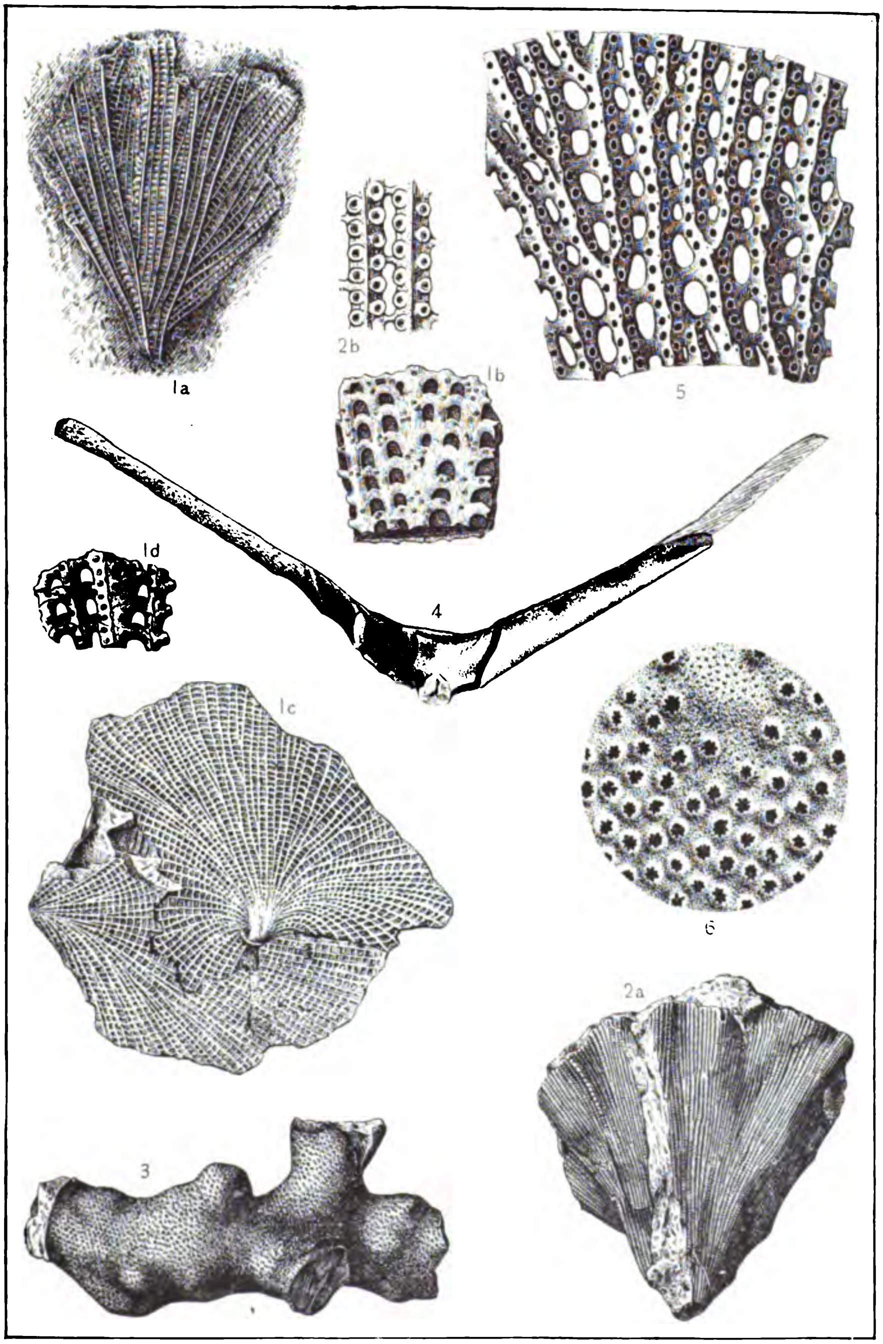
FIG. 2. *Fenestella shumardi* 24
2a. Specimen well preserved. (Hare collection.)
2b. Surface (enlarged).
Carboniferous, Upper Coal Measures.

FIG. 3. *Fistulipora nodulifera*.
Part of a branch. (Hare collection.)
Carboniferous, Upper Coal Measures.

FIG. 4. *Lyropora retrorsa* 27
Marginal support. (Mus. Mo. Geol. Sur.)
Carboniferous, Burlington limestone.

FIG 5. *Fenestella rudis* 23
Fragment. (After Ulrich.)
Carboniferous, Keokuk limestone.

FIG. 6. *Actinotrypa peculiaris* 18
Surface (enlarged).
Carboniferous, Keokuk limestone.



POLYZOANS.

PLATE XXXV.

EXPLANATION OF PLATE XXXV.

		Page
FIG. 1.	*Conularia missouriensis*	218
1a.	Large specimen. (Mus. Mo. Geol. Sur.)	
1b.	Cross-section of same.	
	Carboniferous, Saint Louis limestone.	
FIG. 2.	*Conularia crusula*	219
	Medium-sized specimen. (Mus. Mo. Geol. Sur.)	
	Carboniferous, Upper Coal Measures.	
FIG. 3.	*Tentaculites incurvus*	217
3a.	Type. (After Shumard)	
3b.	Part of same (enlarged).	
	Silurian, Girardeau limestone.	
FIG. 4.	*Lingula umbonata*	38
	Average-sized specimen.	
	Carboniferous, Upper Coal Measures.	
FIG. 5.	*Lingulella lamborni*	38
	Views of different specimens. (Mus. Mo. Geol. Sur.)	
	Cambrian limestone.	
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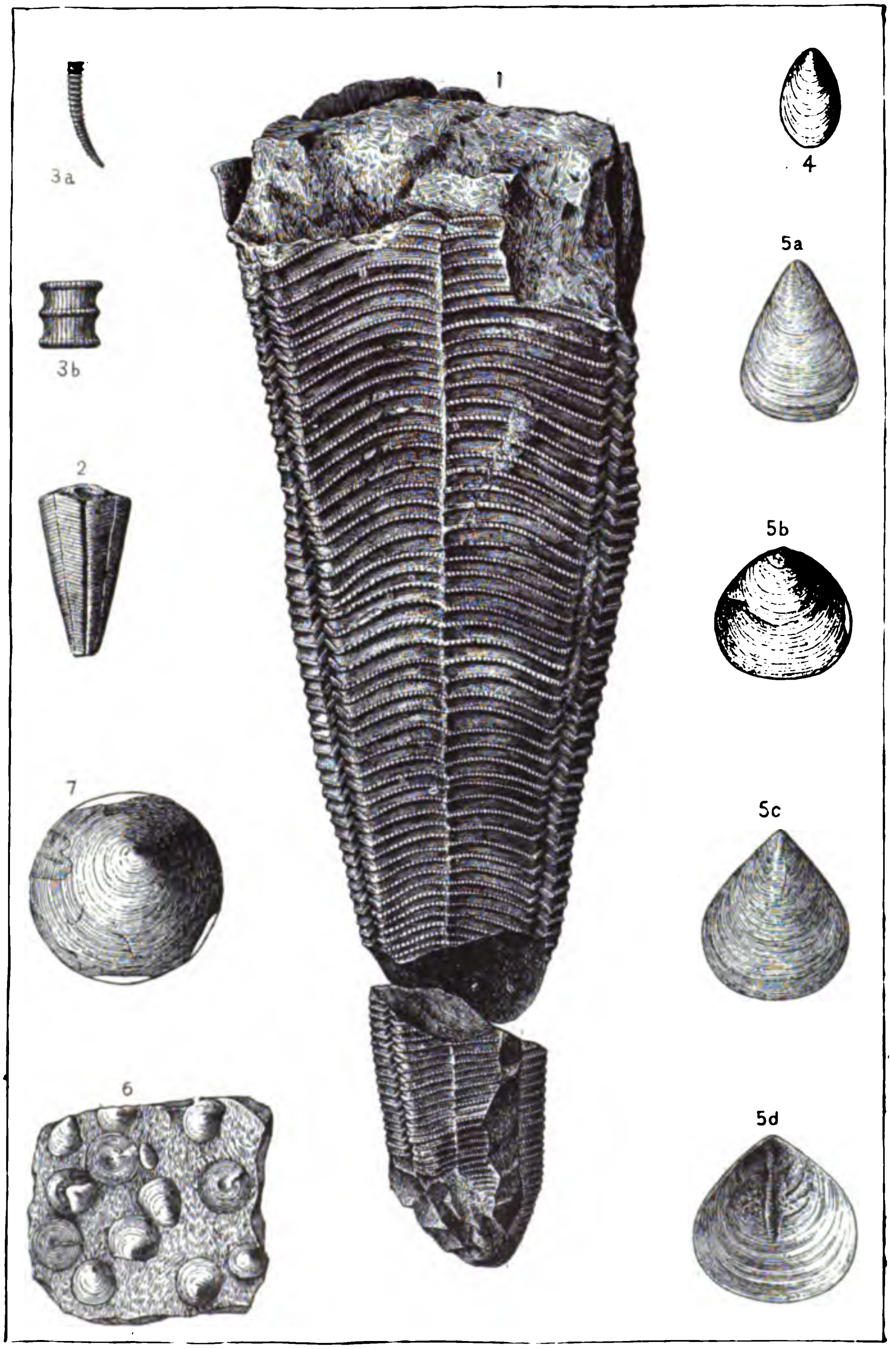
	Several examples on shale.	
	Carboniferous, Upper Coal Measures.	
FIG. 7.	*Discina convexa*	40
	A large specimen.	
	Carboniferous, Upper Coal Measures.	



BRACHIOPODS.

PLATE XXXVI.

Explanation of Plate XXXVI.

		Page
Fig. 1.	*Productus costatus*	51
1a.	Ventral view.	
1b.	Dorsal view.	
1c.	Side view.	
	Carboniferous, Upper Coal Measures.	
Fig. 2.	*Productus symmetricus*	48
2a.	Side aspect.	
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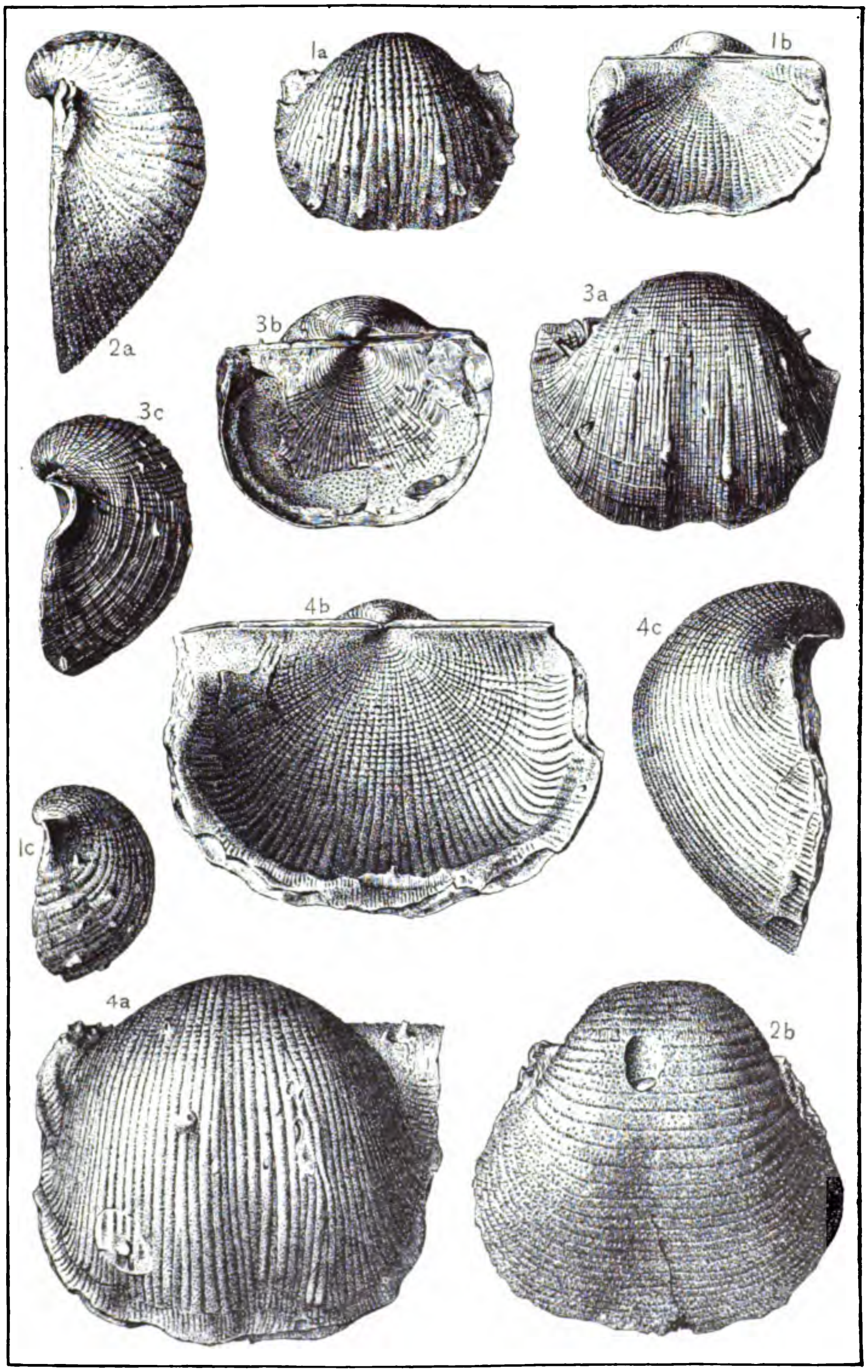
	Carboniferous, Upper Coal Measures.	
Fig. 3.	*Productus costatus?*	51
3a.	Ventral view.	
3b.	Dorsal aspect.	
3c.	Side view.	
	Carboniferous, Upper Coal Measures.	
Fig. 4.	*Productus semireticulatus*	50
4a.	Ventral aspect.	
4b.	Dorsal view.	
4c.	Side view.	
	Carboniferous, Upper Coal Measures.	



BRACHIOPODS.

PLATE XXXVII.

EXPLANATION OF PLATE XXXVII.

Page

FIG. 1. *Productus punctatus* 51

1a. Side view.

1b. Dorsal view.

1c. Ventral view.

Carboniferous, Upper Coal Measures.

FIG. 2. *Productus cora* 47

2a. Ventral aspect.

2b. Dorsal view.

2c. Ventral view of another variety.

Carboniferous, Upper Coal Measures.

FIG. 3. *Productus nebrascensis* 48

3a. Dorsal view.

3b. Side view.

3c. Ventral view.

Carboniferous, Upper Coal Measures.

FIG. 4. *Productus longispinus* 45

4a. Dorsal view.

4b. Ventral aspect.

Carboniferous, Upper Coal Measures.

FIG. 5. *Chonetes lævis* 55

5a. Ventral view of type specimen.

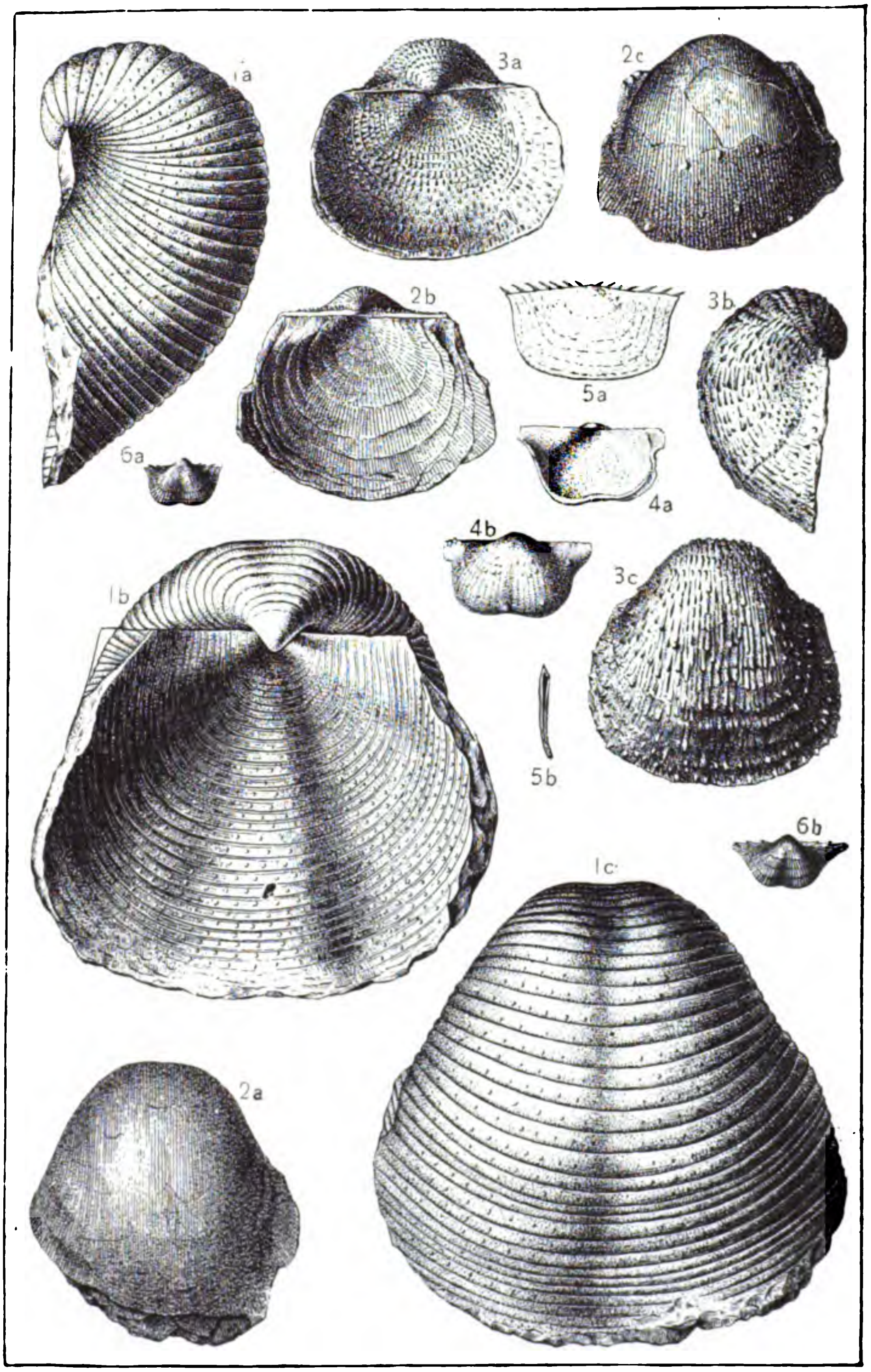
5b. Longitudinal section of same.

Carboniferous, Lower Coal Measures.

FIG. 6. *Chonetes flemingi* 54

6a. Ventral view of specimen with short hinge-line.

6b. Ventral aspect of example with long hinge-line.

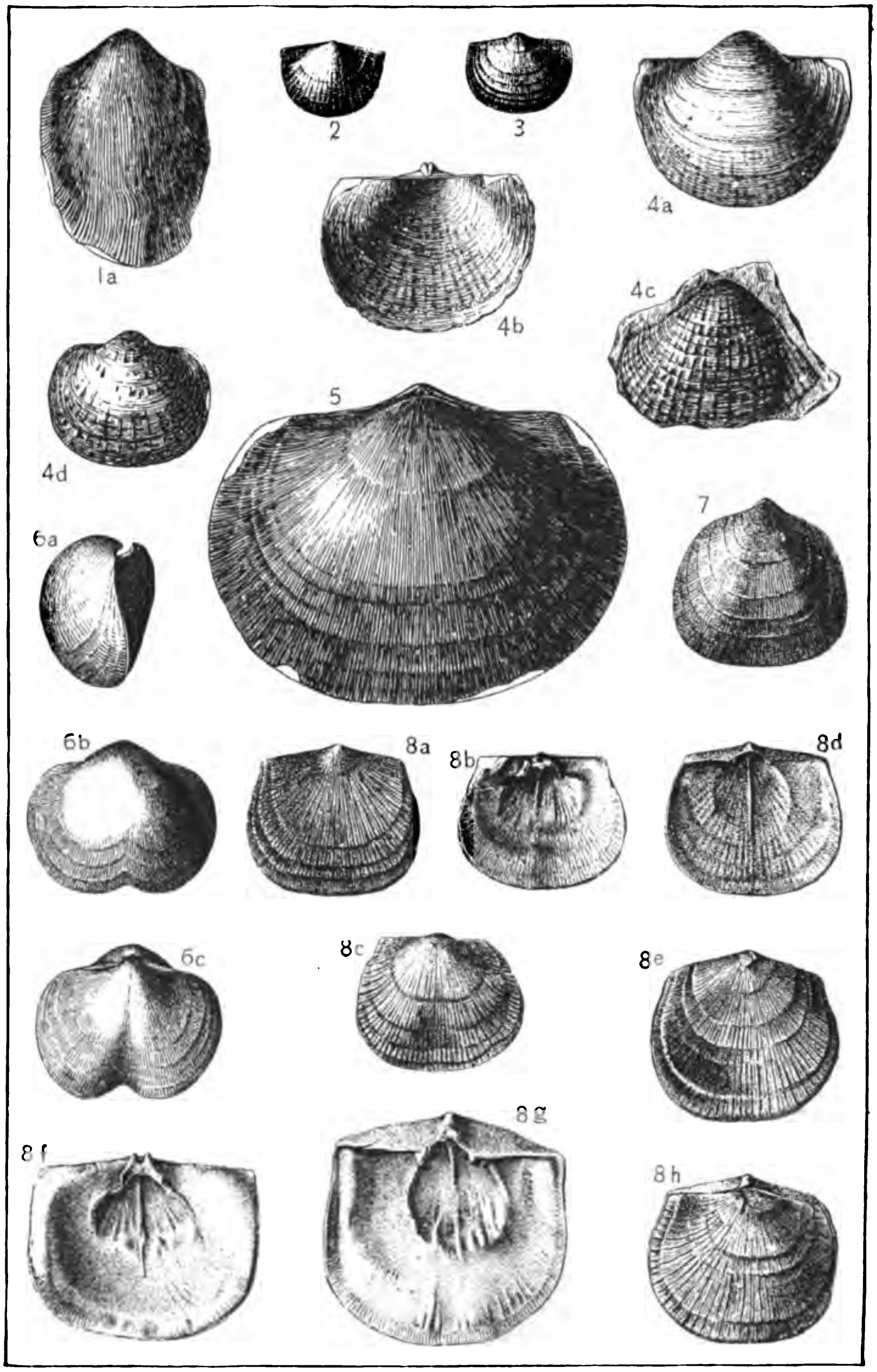


BRACHIOPODS.

PLATE XXXVIII.

EXPLANATION OF PLATE XXXVIII.

			Page
FIG. 1.		*Productus lævicostus*	44
	1a.	Ventral aspect.	
		Carboniferous, Kinderhook shales.	
FIG. 2.		*Chonetes ornata*	53
	2a.	Ventral view.	
		Carboniferous ?, Louisiana (Kinderhook) limestone.	
FIG. 3.		*Chonetes genicula*	53
		Specimen enlarged two diameters.	
		Carboniferous?, Louisiana (Kinderhook) limestone.	
FIG. 4.		*Productella pyxidata*	52
	4a.	Ventral aspect of a smooth variety.	
	4b.	Dorsal view of smooth shell.	
	4c.	Ventral aspect of a ribbed shell.	
	4d.	Ventral view of subspinous variety.	
		Carboniferous ?, Louisiana (Kinderhook) limestone.	
FIG. 5.		*Orthis swallowi*	63
		View of a large example.	
		Carboniferous, Burlington limestone.	
FIG. 6.		*Orthis iowensis*	62
	6a.	Side view.	
	6b.	Dorsal aspect.	
	6c.	Ventral valve.	
		Devonian, Callaway limestone.	
FIG. 7.		*Orthis burlingtonensis*	63
		A mature individual.	
		Carboniferous, Burlington limestone.	
FIG. 8.		*Streptorhynchus crenistria*	67
	8a.	Ventral valve, exterior.	
	8b.	Dorsal valve inside.	
	8c.	Dorsal valve, outside.	
	8d.	Ventral valve, interior.	
	8e.	Ventral aspect.	
	8f.	Dorsal valve, inside.	
	8g.	Ventral valve, inside.	
	8h.	Dorsal aspect.	
		Carboniferous, Upper Coal Measures.	

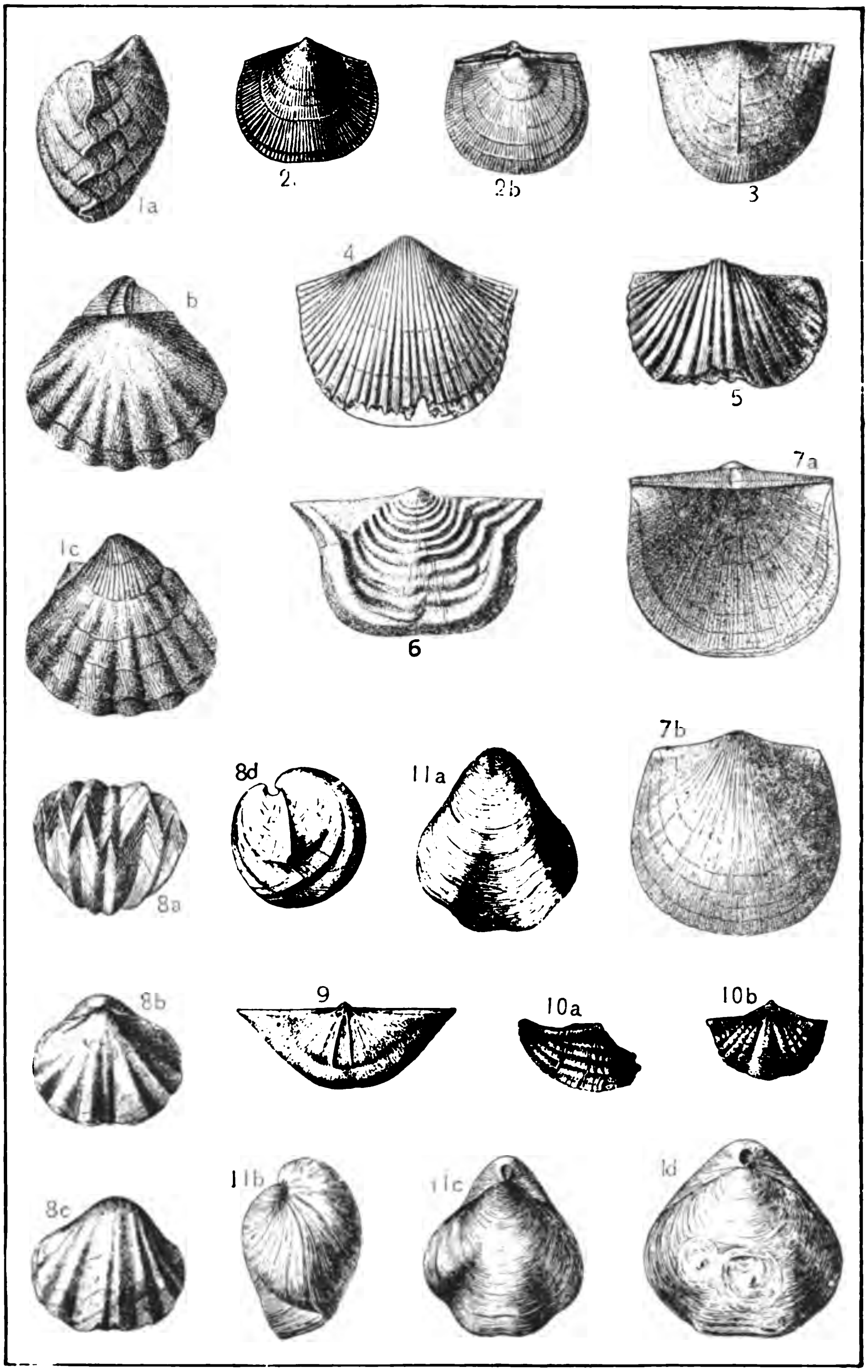


BRACHIOPODS.

PLATE XXXIX.

EXPLANATION OF PLATE XXXIX.

			Page
FIG.	1.	*Meekella striatocostata*	68
	1a.	Side view.	
	1b.	Dorsal aspect.	
	1c	Ventral view.	
		Carboniferous, Upper Coal Measures.	
FIG.	2.	*Streptorhynchus lens*	67
	2a.	Ventral aspect (Mus. Mo Geol. Sur.)	
	2b.	Dorsal aspect of same.	
		Carboniferous ? Louisiana (Kinderhook) limestone.	
FIG.	3.	*Strophomena alternata*	70
		An average size specimen. (Mus. Mo. Geol. Sur.)	
		Silurian, Trenton limestone.	
FIG.	4.	*Orthis tricenaria*	60
		Ventral aspect. (Mus. Mo. Geol. Sur.)	
		Silurian, Trenton limestone.	
FIG	5.	*Platystrophia lynx*	64
		Dorsal view. (Mus. Mo. Geol. Sur.)	
		Silurian, Trenton limestone.	
FIG.	6	*Plectambonites rhomboidalis*, var	70
		Ventral aspect. (Rowley collection.)	
		Carboniferous, Lower Burlington limestone.	
FIG.	7.	*Strophodonta demissa*	70
	7a.	Dorsal aspect.	
	7b.	Ventral view.	
		Devonian, Hamilton limestone.	
FIG.	8.	*Syntrilasma hemiplicata*	76
	8a.	Anterior view.	
	8b.	Dorsal view.	
	8c.	Ventral view.	
	8d.	Side view.	
		Carboniferous, Upper Coal Measures.	
FIG.	9	*Leptæna sericea*	75
		Interior side (Mus. Mo. Geol. Sur)	
		Silurian, Hudson river shales.	
FIG.	10	*Cyrtina acutirostris*	89
	10a.	Side view (Mus. Mo. Geol. Sur)	
	10b.	Dorsal aspect of same.	
		Carboniferous ?, Louisiana (Kinderhock) limestone.	
FIG.	11.	*Athyris argentea*	92
	11a.	Ventral aspect.	
	11b.	Side view	
	11c.	Dorsal aspect.	
	11d.	Dorsal aspect.	
		Carboniferous, Coal Measures.	



BRACHIOPODS.

PLATE XL.

EXPLANATION OF PLATE XL.

		Page
FIG. 1.	*Spirifera marionensis*	78
1a.	Dorsal aspect. (Mus. Mo. Geol. Sur.)	
1b.	Same of another specimen. (Same cabinet.)	
	Carboniferous ? Louisiana, (Kinderhook) limestone.	
FIG. 2.	*Spirifera keokuk*	81
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	Carboniferous, Keokuk limestone.	
FIG. 3.	*Spirifera forbesi*	80
	Ventral view. (Mus. Mo. Geol. Sur.)	
	Carboniferous, Burlington limestone.	
FIG. 4.	*Spirifera parryana*	77
4a.	Ventral aspect.	
4b.	Dorsal view of same.	
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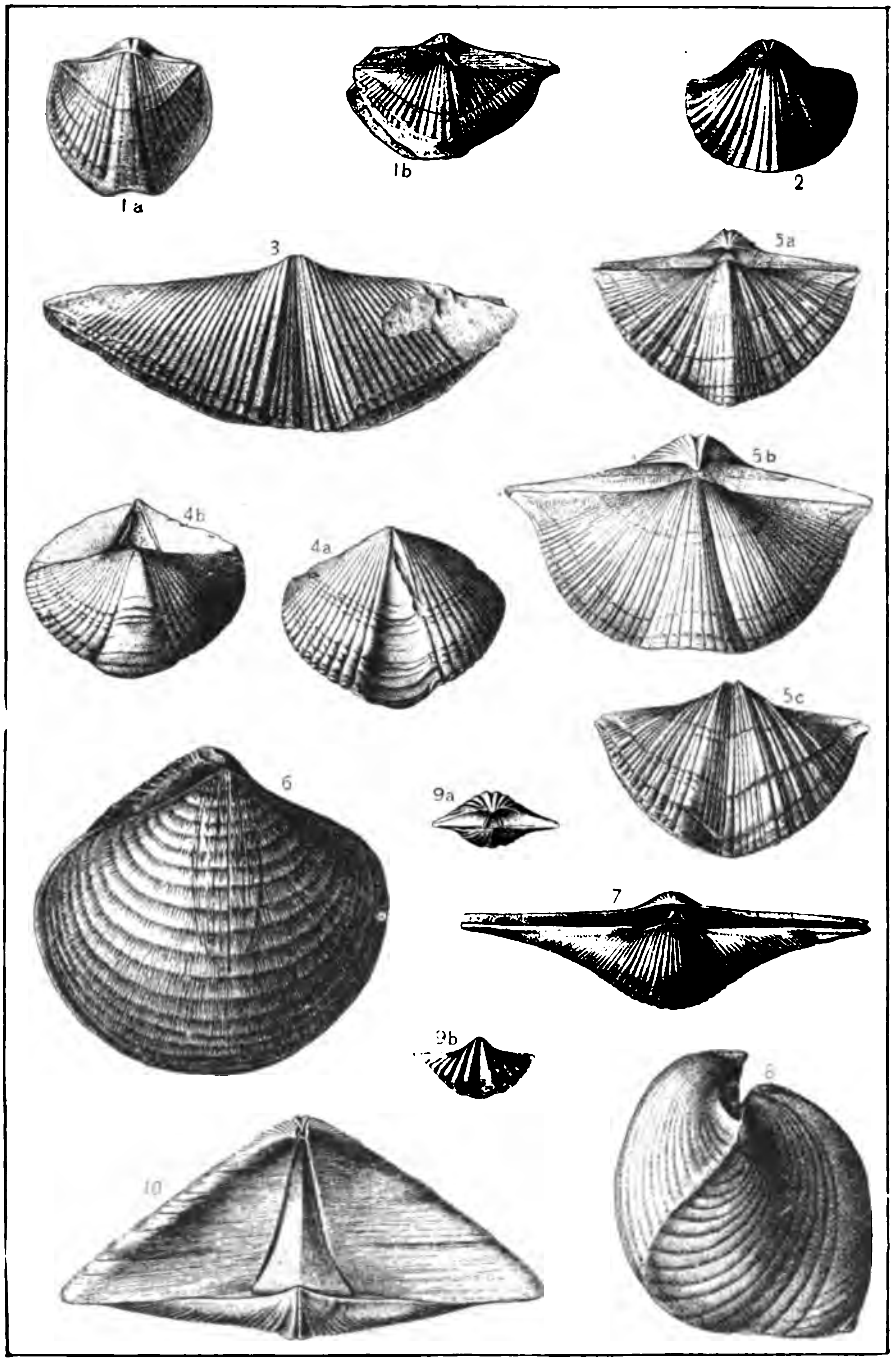
FIG. 5.	*Spirifera camerata*	83
5a.	Dorsal view.	
5b.	Dorsal aspect.	
5c.	Ventral valve.	
	Carboniferous, Coal Measures.	
FIG. 6.	*Spirifera lineatoides*	80
	Dorsal aspect of an exfoliated specimen. (Mus. Mo. Geol. Sur.)	
	Carboniferous, Burlington limestone.	
FIG. 7.	*Spirifera sp.?*	
	Dorsal aspect. (Keyes collection.)	
	Carboniferous, Kinderhook shales.	
FIG. 8.	*Syringothyris plenus*	88
	Side view. (Keyes collection.)	
	Carboniferous, Burlington limestone.	
FIG. 9.	*Spiriferina kentuckensis*	86
9a.	Posterior view.	
9b.	Ventral view.	
	Carboniferous, Coal Measures.	
FIG. 10.	*Syringothyris carteri*	87
	Posterior view. (Mus. Mo. Geol. Sur.)	
	Carboniferous, Burlington limestone.	



BRACHIOPODS.

Explanation of Plate XLI.

Page.

Fig. 1. *Athyris vittata* 90
1a. Dorsal view.
1b. Ventral aspect.
Devonian, Hamilton limestone.

Fig. 2. *Retzia mormoni* 95
2a. Side view
2b. Dorsal aspect.
2c. Ventral view.
Carboniferous, Upper Coal Measures.

Fig. 3. *Rhynchonella dentata* 100
Ventral aspect. (Mus. Mo. Geol. Sur.)
Silurian, Trenton limestone.

Fig. 4. *Retzia sp.?*
Dorsal aspect. (Mus. Mo. Geol. Sur.)
Carboniferous, Lower Burlington limestone.

Fig. 5. *Nucleospira pisiformis* 94
Ventral aspect. (Mus. Mo. Geol. Sur.)
Silurian, Niagara ? limestone.

Fig. 7. *Rhynchonella uta* 103
Ventral aspect.
Carboniferous, Upper Coal Measures.

Fig. 8. *Rhynchonella sp.?*
8a. Dorsal aspect. (Davis collection)
8b. Side view. (Davis collection.)
Carboniferous, Burlington limestone.

Fig. 9. *Athyris hannibalensis* 91
Ventral aspect. (Mus. Mo. Geol. Sur.)
Carboniferous ? Louisiana (Kinderhook) limestone.

Fig 10. *Athyris incrassatus* 91
Dorsal aspect. (Mus. Mo. Geol. Sur.)
Carboniferous, Burlington limestone.

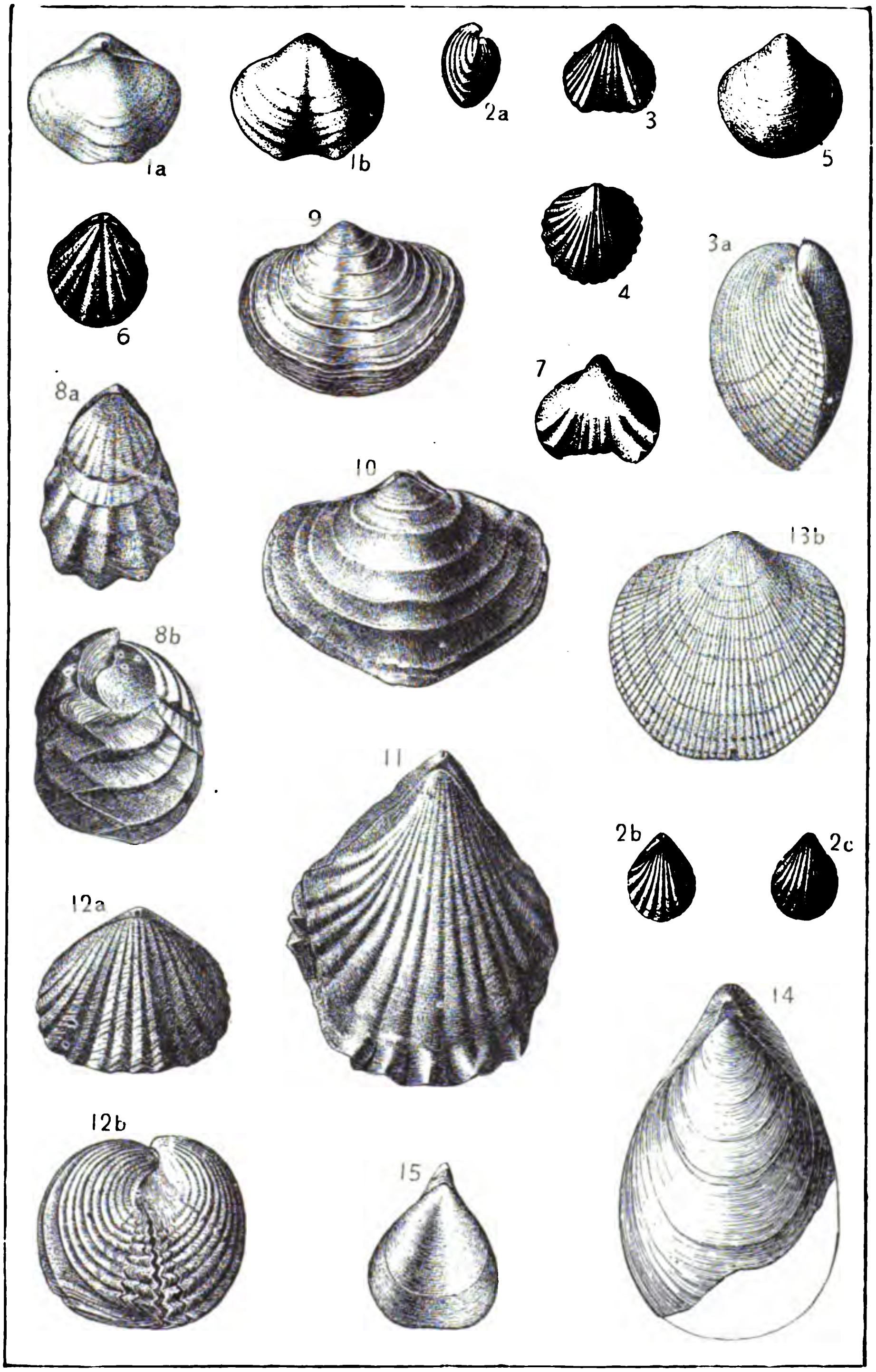
Fig. 11. *Rhynchonella sp ?*
Dorsal view. (Keyes collection)
Carboniferous, Kinderhook shales.

Fig. 12. *Rhynchonella capax* 99
12a. Dorsal view. (Mus. Mo Geol. Sur)
12b. Side view. (Mus. Mo. Geol Sur)
Silurian, Hudson River shales.

Fig. 13. *Atrypa reticularis* 97
13a. Side view.
13b. Dorsal aspect.
Devonian, Hamilton limestone.

Fig. 14. *Terebratula sp.?*
Dorsal view. (Rowley collection)
Carboniferous, Burlington limestone.

Fig. 15. *Terebratula rowleyi* 105
Dorsal aspect. (Rowley collection.)
Carboniferous, Lower Burlington limestone.



BRACHIOPODS.

PLATE XLI.

Explanation of Plate XLI.

Page.

Fig. 1. *Athyris vittata* 90
1a. Dorsal view.
1b. Ventral aspect.
Devonian. Hamilton limestone.

Fig. 2. *Retzia mormoni* 95
2a. Side view
2b. Dorsal aspect.
2c. Ventral view.
Carboniferous, Upper Coal Measures.

Fig. 3. *Rhynchonella dentata* 100
Ventral aspect. (Mus. Mo. Geol. Sur.)
Silurian, Trenton limestone.

Fig. 4. *Retzia sp.?*
Dorsal aspect. (Mus. Mo. Geol. Sur.)
Carboniferous, Lower Burlington limestone.

Fig. 5. *Nucleospira pisiformis* 94
Ventral aspect. (Mus. Mo. Geol. Sur.)
Silurian, Niagara ? limestone.

Fig. 7. *Rhynchonella uta* 108
Ventral aspect.
Carboniferous, Upper Coal Measures.

Fig. 8. *Rhynchonella sp. ?*
8a. Dorsal aspect. (Davis collection)
8b. Side view. (Davis collection.)
Carboniferous, Burlington limestone.

Fig. 9. *Athyris hannibalensis* 91
Ventral aspect. (Mus. Mo. Geol. Sur.)
Carboniferous ? Louisiana (Kinderhook) limestone.

Fig 10. *Athyris incrassatus*. 91
Dorsal aspect. (Mus. Mo. Geol. Sur.)
Carboniferous, Burlington limestone.

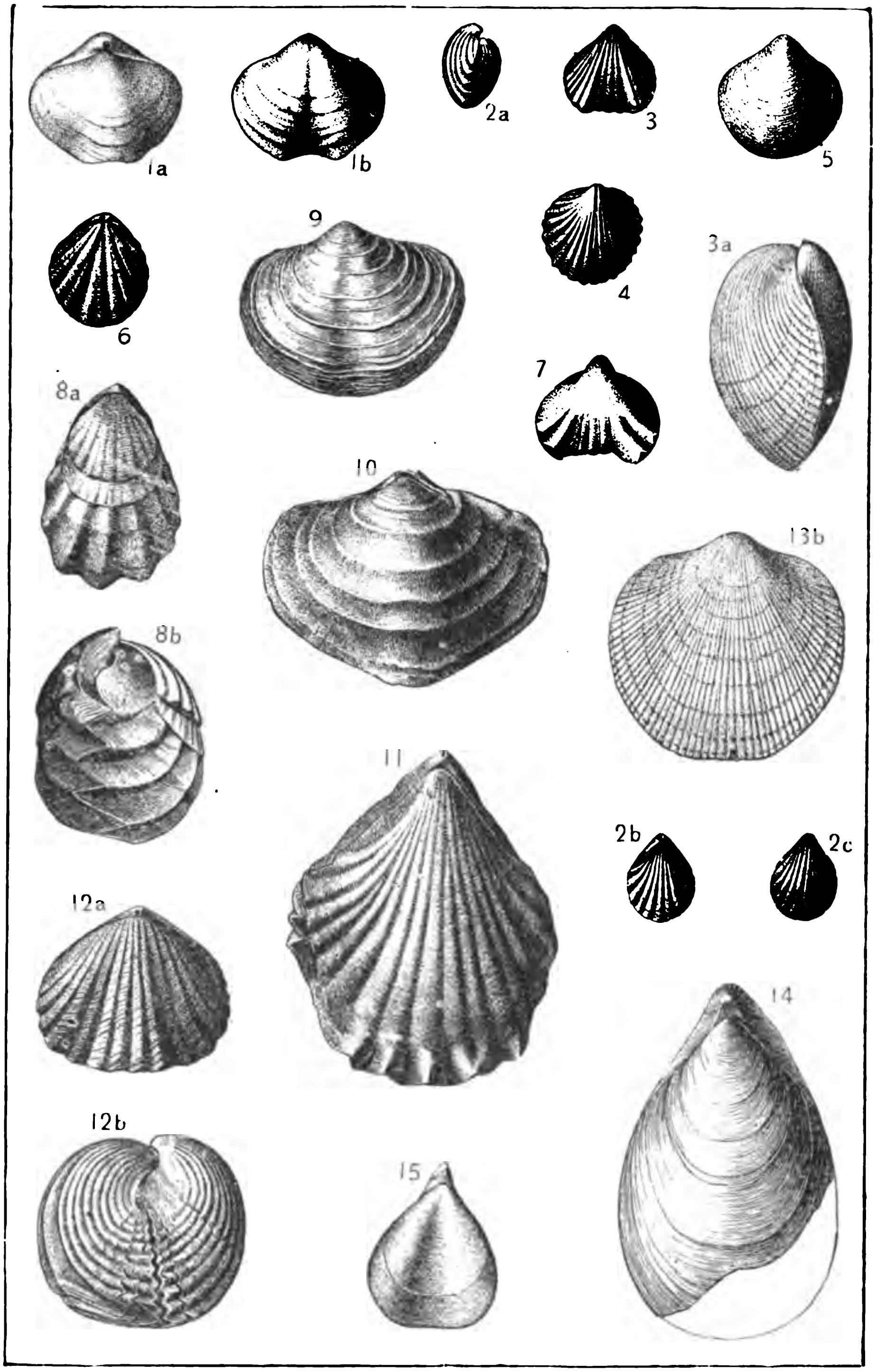
Fig. 11. *Rhynchonella sp ?*
Dorsal view. (Keyes collection)
Carboniferous, Kinderhook shales.

Fig. 12. *Rhynchonella capax* 99
12a. Dorsal view. (Mus. Mo Geol. Sur)
12b. Side view. (Mus. Mo. Geol Sur)
Silurian, Hudson River shales.

Fig. 13. *Atrypa reticularis* 97
13a. Side view.
13b Dorsal aspect.
Devonian, Hamilton limestone.

Fig. 14. *Terebratula sp. ?*
Dorsal view. (Rowley collection)
Carboniferous, Burlington limestone.

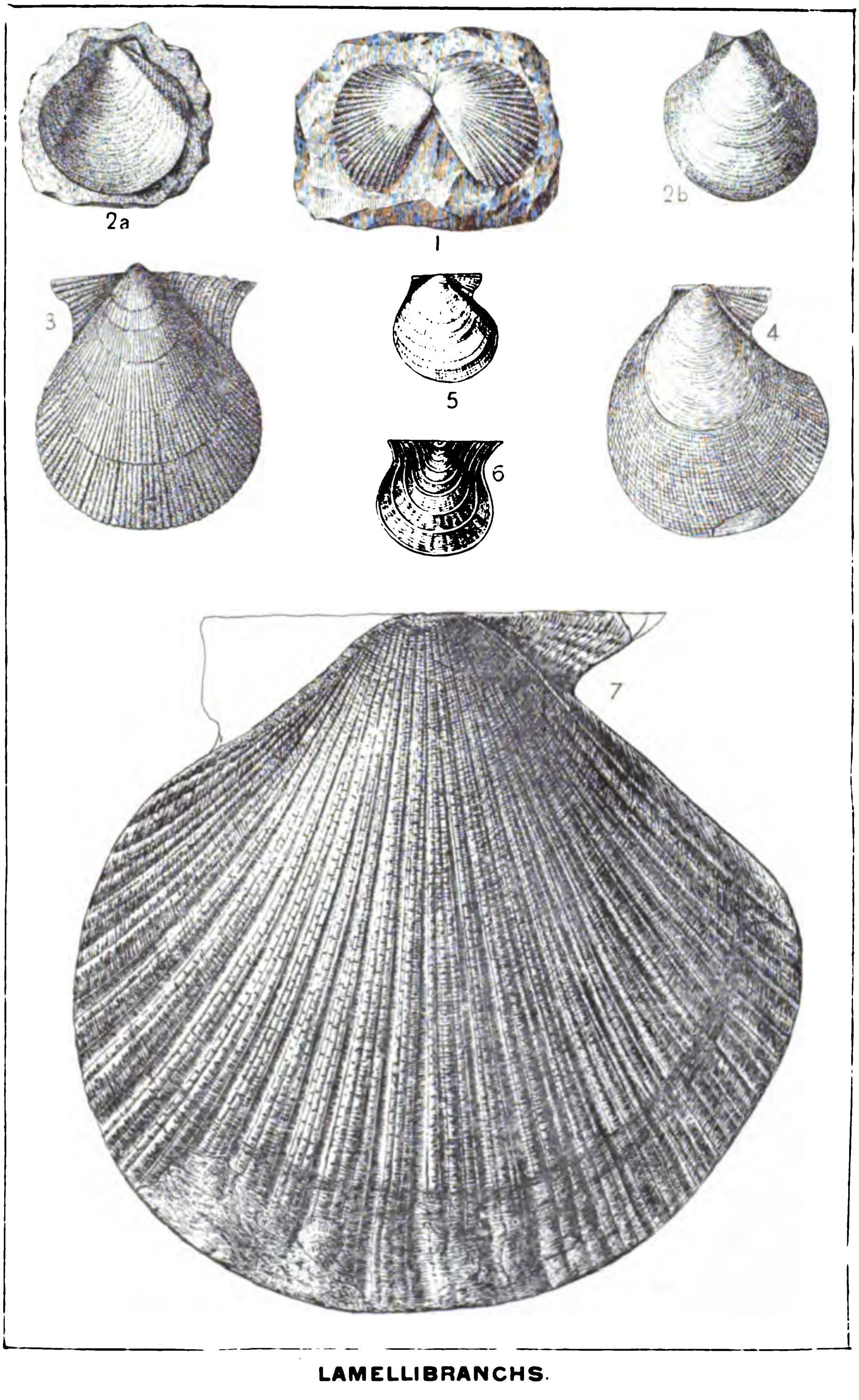
Fig. 15. *Terebratula rowleyi* 105
Dorsal aspect. (Rowley collection.)
Carboniferous, Lower Burlington limestone.



BRACHIOPODS.

Explanation of Plate XLII.

		Page.
Fig. 1.	*Lima retifera*	108
	Both valves.	
	Carboniferous, Coal Measures.	
Fig. 2.	*Entolium aviculatum*	109
2a.	Interior aspect.	
2b.	Outside.	
	Carboniferous, Upper Coal Measures.	
Fig. 3.	*Aviculopecten occidentalis*	110
	Left valve.	
	Carboniferous, Upper Coal Measures,	
Fig. 4.	*Pseudemonotis hawni (?)*	
	A finely-preserved shell. (Hare collection.)	
	Carboniferous, Upper Coal Measures.	
Fig. 5.	*Aviculopecten sp.?*	
	A medium-sized shell. (Mus. Mo. Geol. Sur.)	
	Carboniferous, Lower Burlington limestone.	
Fig. 6.	*Aviculopecten interlineatus*	112
	Specimen with concentric markings well defined.	
	Carboniferous, Upper Coal Measures.	
Fig. 7.	*Aviculopecten fasciculatus*	113
	A large example. (Hare collection.)	
	Carboniferous, Upper Coal Measures.	



LAMELLIBRANCHS.

PLATE XLIII.

Explanation of Plate XLIII.

Page

Fig. 1. *Monopteria longispina*. 114
Left valve. (Hare collection.)
Carboniferous, Upper Coal Measures.

Fig. 2. *Monopteria gibbosa* 114
2a. Right valve.
2b. Anterior view of same.
Carboniferous, Upper Coal Measures.

Fig. 3. *Myalina swallowi* 119
3a. Right valve.
3b. Left valve.
3c. Dorsal aspect.
Carboniferous, Upper Coal Measures.

Fig. 4. *Aviculopecten carboniferus*. 111
4a. Valve showing markings.
4b. Opposite valve.
Carboniferous, Upper Coal Measures.

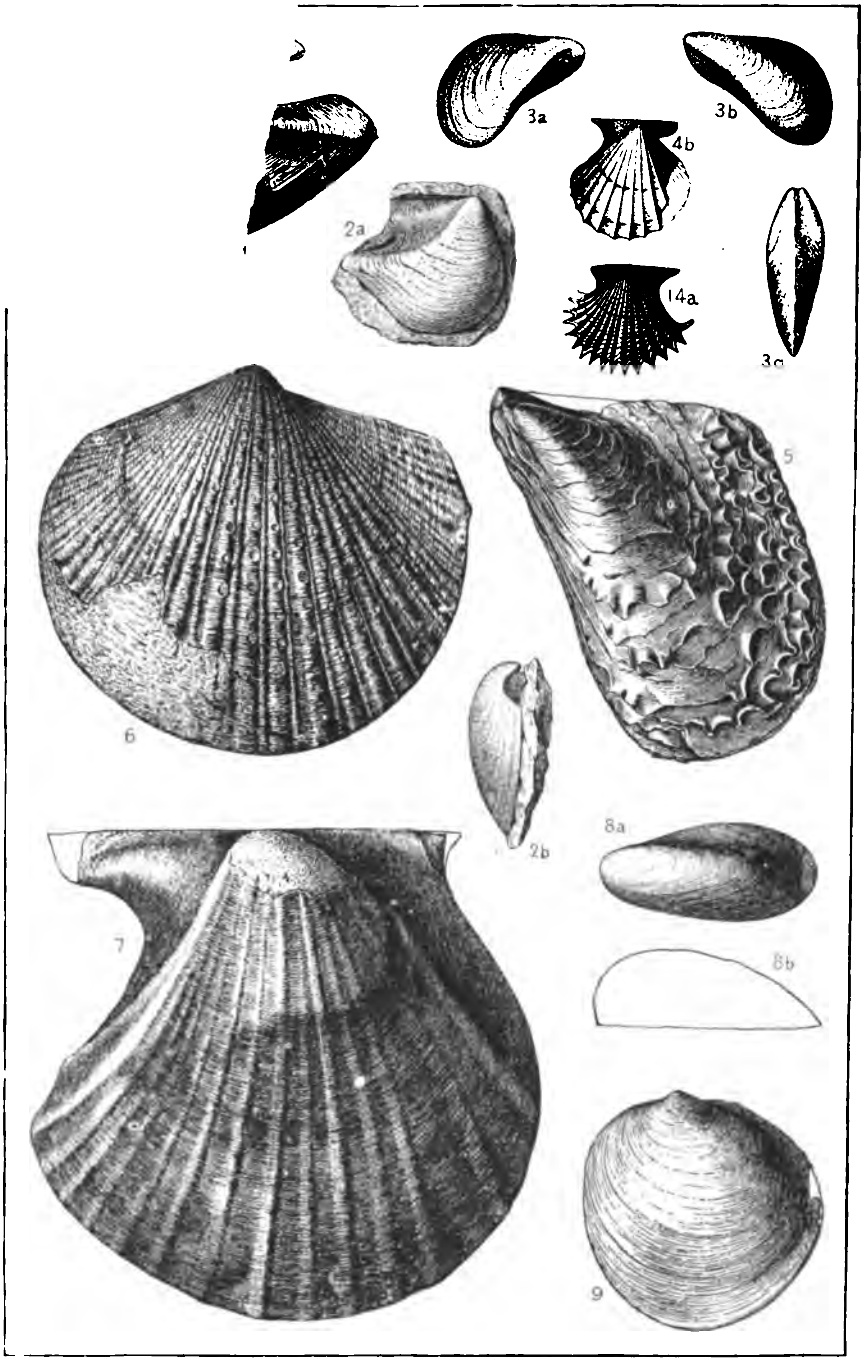
Fig. 5. *Myalina kansasensis*... 117
Shell showing imbricated lines of growth. (Calvin collection.)
Carboniferous, Upper Coal Measures.

Fig. 6. *Aviculopecten sp.* ?
Specimen with ears broken away. (Hare collection.)
Carboniferous, Upper Coal Measures.

Fig. 7. *Aviculopecten magna*... 110
Medium-sized specimen. (Shepard collection.)
Carboniferous, Burlington limestone.

Fig. 8. *Lithophaga sp.* ?. 116
8a. Left valve. (Rowley collection.)
8b. Dorsal outline of same.
Carboniferous, Lower Burlington limestone.

Fig. 9. *Placunopsis carbonaria*... 108
Left side. (Hare collection.)
Carboniferous, Upper Coal Measures.



LAMELLIBRANCHS.

PLATE XLIV.

EXPLANATION OF PLATE XLIV.

Page

FIG. 1. *Myalina subquadrata*.. 118

1a. Interior of valve.

1b. Exterior of same.

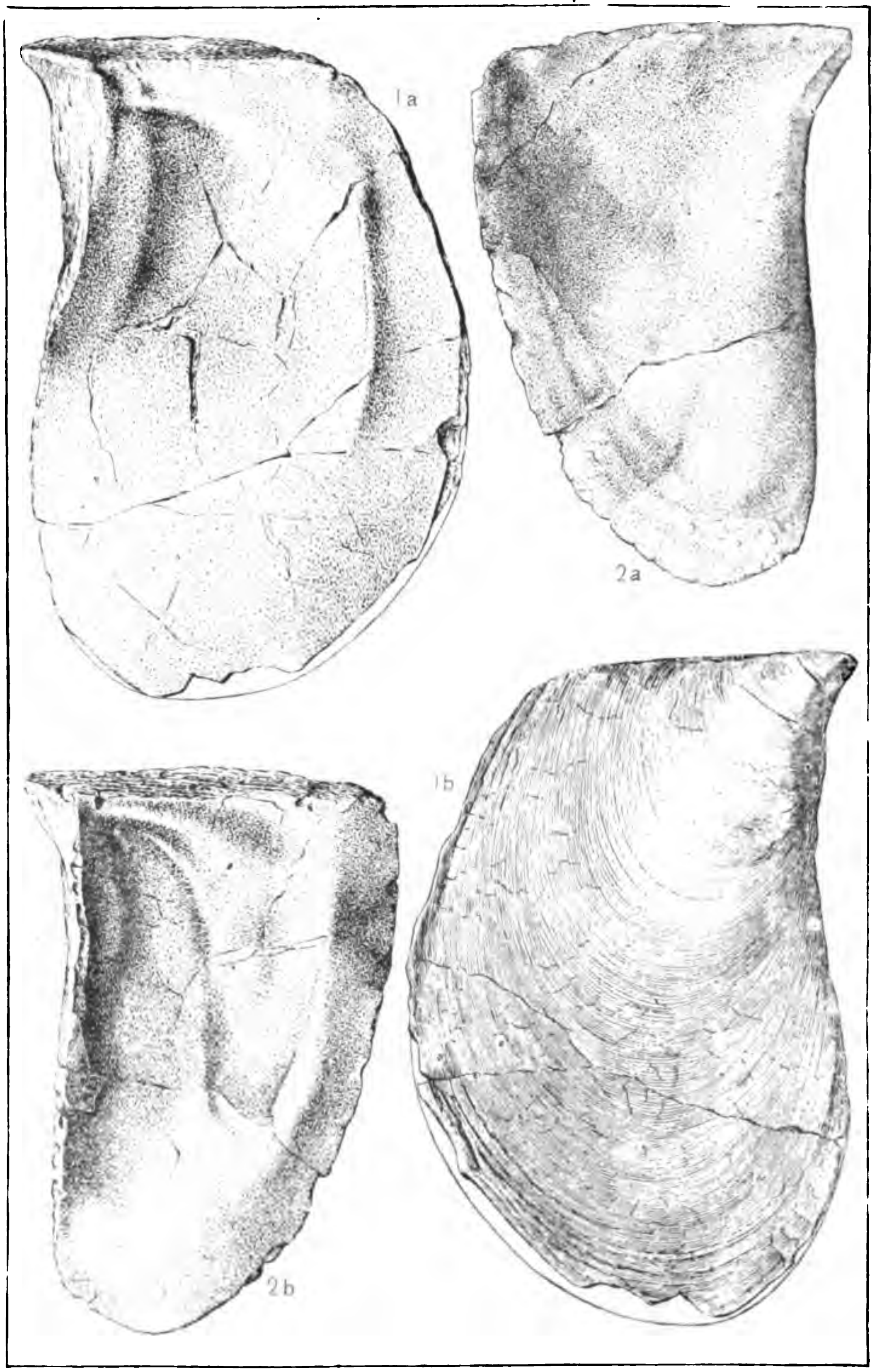
Carboniferous, Upper Coal Measures.

FIG. 2. *Myalina subquadrata*.. 118

2a. Outside of valve.

2b. Inside of same.

Carboniferous, Upper Coal Measures.



LAMELLIBRANCHS

PLATE XLV.

EXPLANATION OF PLATE XLV.

Page

FIG. 1. *Myalina recurvirostris* ....

1a. Interior of valve.

1b. Exterior of same.

Carboniferous, Upper Coal Measures.

FIG. 2. *Pinna peracuta* 116

2a. Side view.

2b. Dorsal aspect

Carboniferous, Upper Coal Measures.

FIG 3. *Nucula ventricosa* 121

3a. Inside view (enlarged).

3b. Right valve.

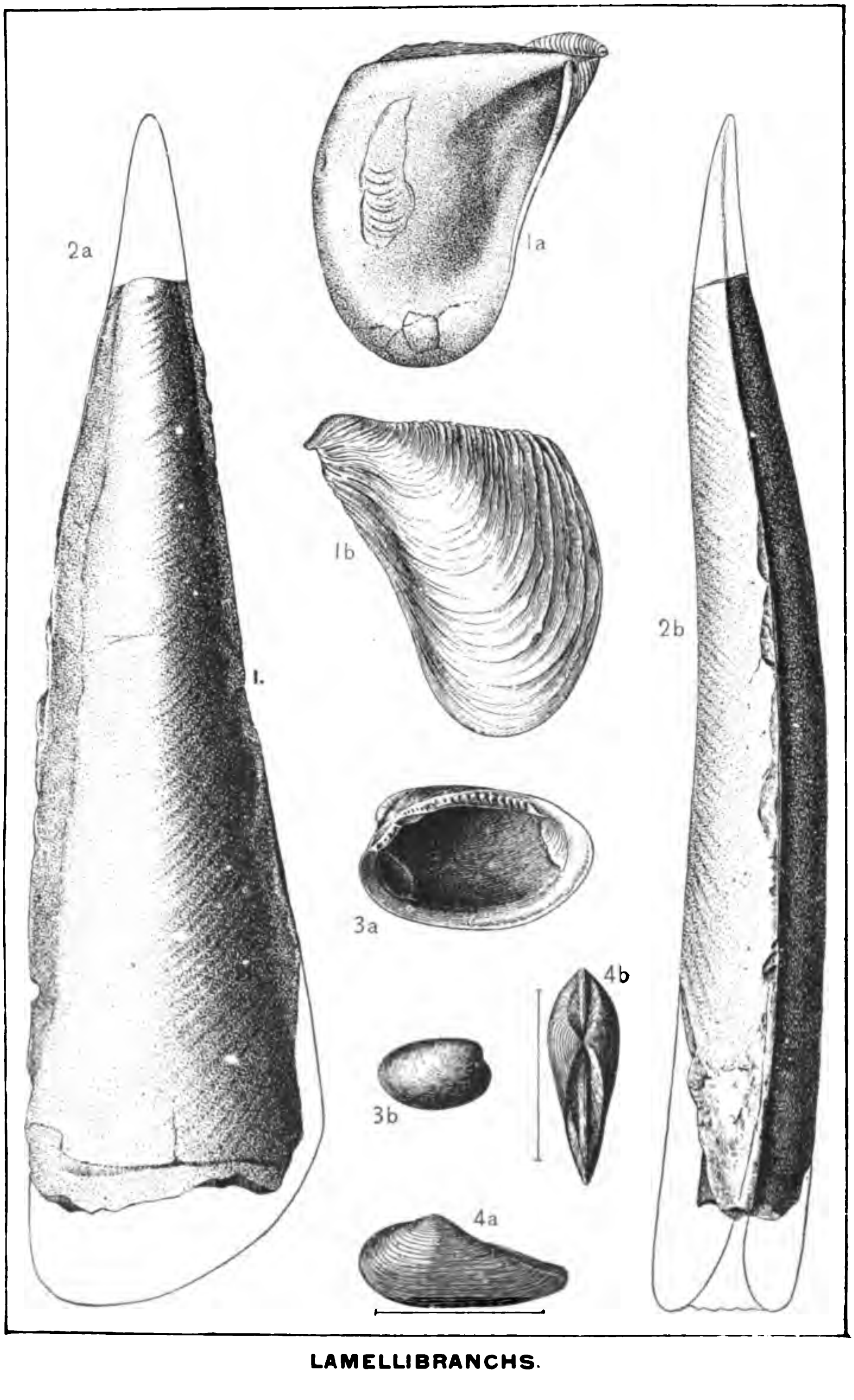
Carboniferous, Coal Measures.

FIG. 4. *Nuculana bellistriata* 122

4a. Left valve.

4b. Dorsal aspect.

Carboniferous, Coal Measures.



LAMELLIBRANCHS.

PLATE XLVI.

EXPLANATION OF PLATE XLVI.

Page.

FIG. 1. *Macrodon obsoletus* 120
Right valve. (Keyes collection.)
Carboniferous, Upper Coal Measures.

FIG. 2. *Macrodon sangamonensis* 121
Right valve enlarged. (Hare collection.)
Carboniferous, Upper Coal Measures.

FIG. 3. *Schizodus wheeleri* 123
3a. Side view of cast. (Mus. Iowa State University.)
3b. Dorsal aspect of same.
3c. Left valve.
Carboniferous, Upper Coal Measures.

FIG. 4. *Schizodus harii* 123
Left valve. (Hare collection)
Carboniferous, Upper Coal Measures.

FIG. 5. *Astartella concentrica ?* 126
Left valve (Hare collection.)
Carboniferous, Upper Coal Measures.

FIG. 6. *Conocardium parrishi* 124
6a. Left valve. (Hare collection.)
6b. Dorsal aspect of same.
Carboniferous, Upper Coal Measures.

FIG. 7. *Astartella vera* 125
Right side. (Broadhead collection.)
Carboniferous, Coal Measures.

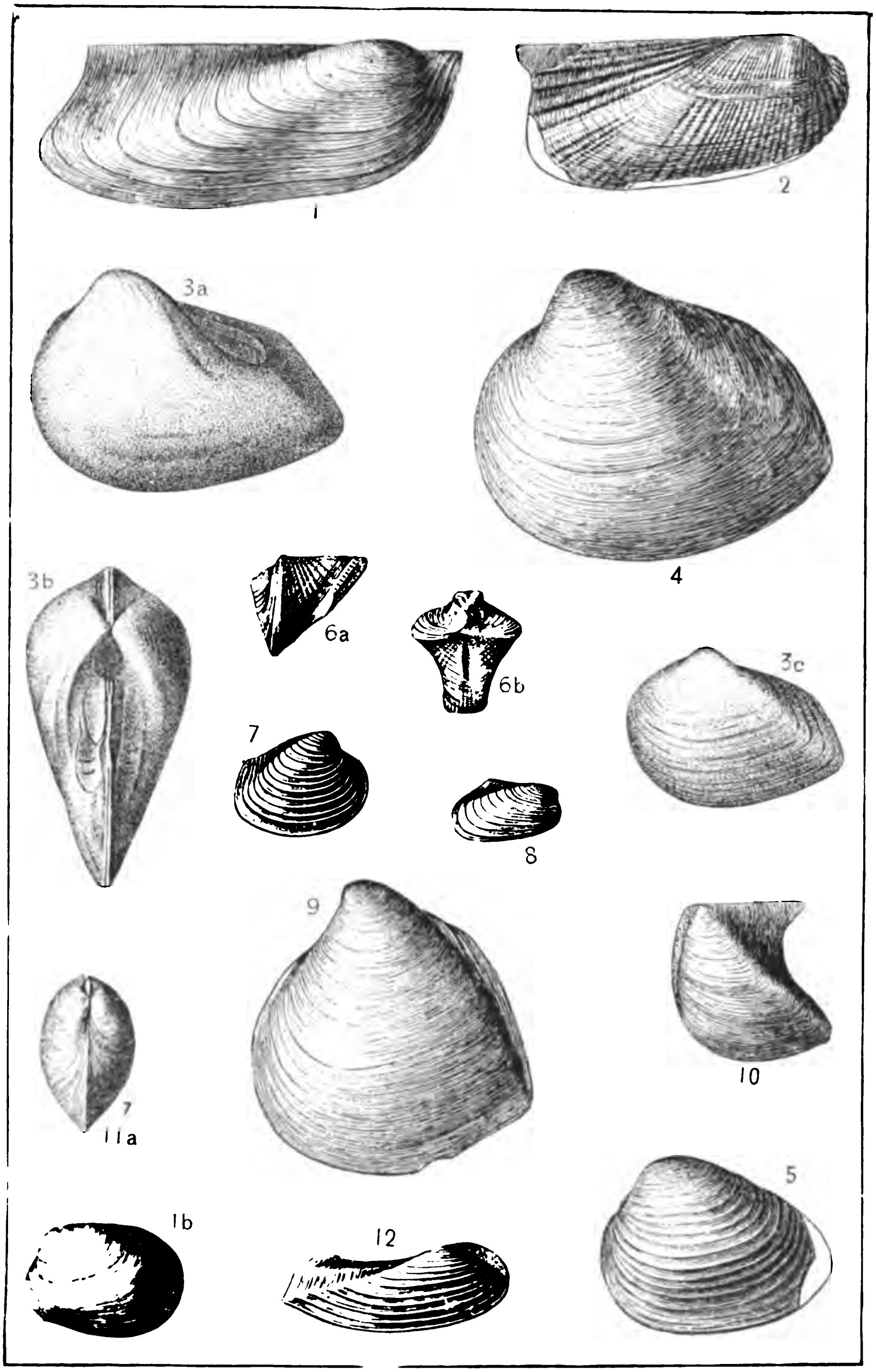
FIG. 8. *Pleurophorus oblongus* 125
Right valve. (Hare collection.)
Carboniferous, Upper Coal Measures.

FIG. 9. *Schizodus sp ?*.
Left valve. (Hare collection)
Carboniferous, Coal Measures.

FIG. 10. *Monopteria sp?*.
Left valve. (Hare collection)
Carboniferous, Upper Coal Measures.

FIG. 11. *Clinopistha radiata* 124
11a. Dorsal aspect.
11b. Left valve.
Carboniferous, Coal Measures.

FIG. 12. *Allorisma costata* 128
Right valve. (Hare collection)
Carboniferous, Upper Coal Measures.



LAMELLIBRANCHS.

PLATE XLVII.

Explanation of Plate XLVII.

Page

Fig. 1. *Edmondia aspinwallensis* 128

1a. Right valve.

1b. Dorsal aspect.

Carboniferous, Upper Coal Measures.

Fig. 2. *Edmondia nuptialis* 126

Side view. (Rowley collection.)

Carboniferous, Burlington limestone.

Fig. 3. *Edmondia burlingtonensis* 128

Left valve. (Rowley collection.)

Carboniferous, Burlington limestone.

Fig. 4. *Allorisma sp ?*

Cast of left valve (Rowley collection.)

Carboniferous, Chouteau limestone.

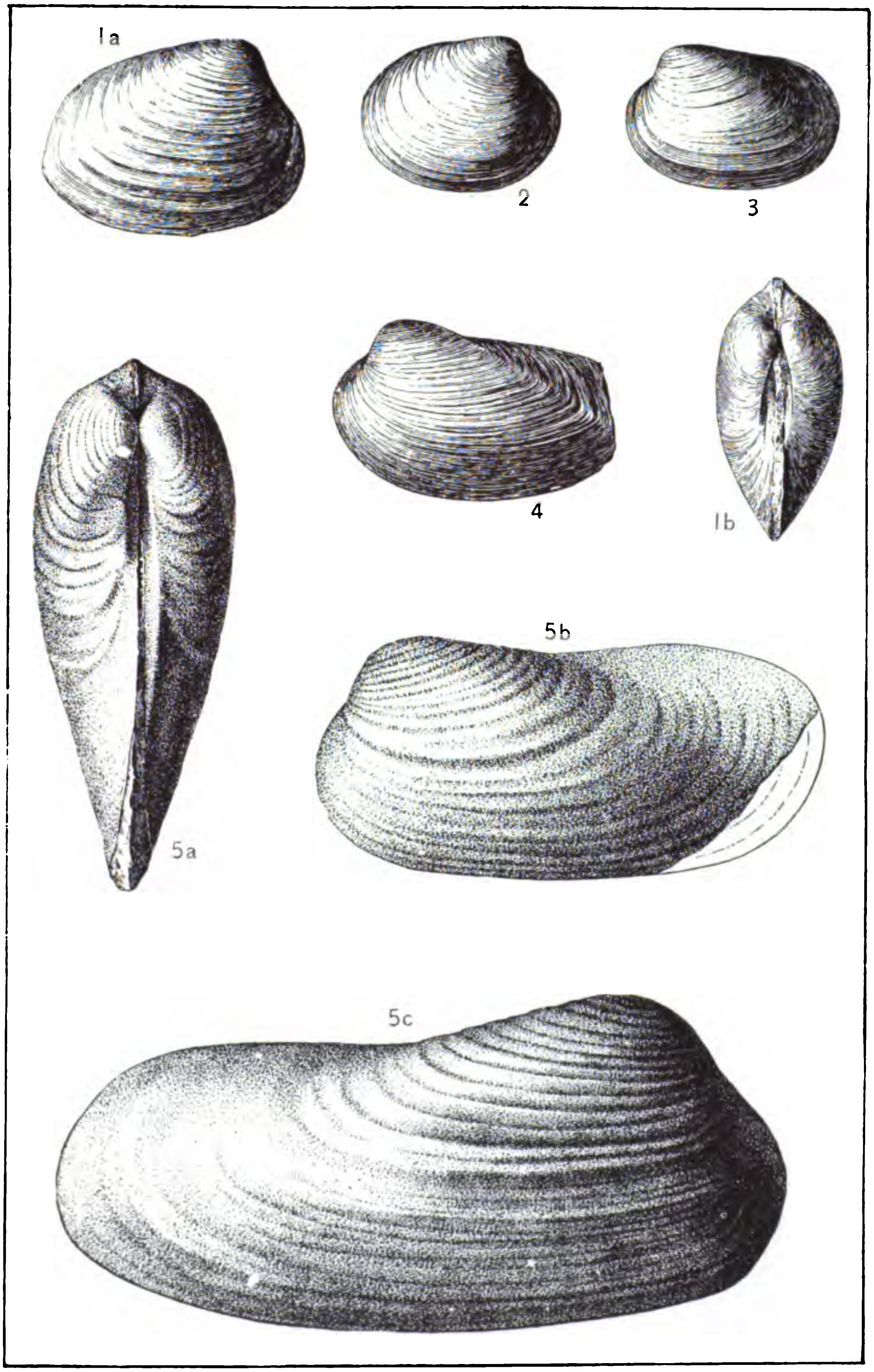
Fig. 5. *Allorisma subcuneatum* 129

5a. Dorsal view.

5b. Aspect of left side.

5c. Right side.

Carboniferous, Upper Coal Measures.



LAMELLIBRANCHS

PLATE XLVIII.

EXPLANATION OF PLATE XLVIII.

		Page
FIG. 1.	*Pleurotomaria broadheadi*	14
1a.	Type specimen. (Broadhead collection.)	
1b.	Another view of same.	
	Carboniferous, Upper Coal Measures.	
FIG. 2.	*Pleurotomaria brazoensis*	142
2a.	View of a well-preserved specimen, x 2. (Keyes collection.)	
2b.	Another view of same.	
	Carboniferous, Lower Coal Measures.	
FIG. 3.	*Pleurotomaria missouriensis*	136
3a.	Side view. (Hare collection)	
3b.	Sutural region (enlarged).	
	Carboniferous, Upper Coal Measures.	
FIG. 4.	*Pleurotomaria sp ?*	
4a.	Side aspect. (Rowley collection.)	
	Carboniferous, Burlington limestone.	
FIG. 5.	*Pleurotomaria perhumerosa*	140
	Side view of a typical specimen.	
	Carboniferous, Upper Coal Measures.	
FIG. 6.	*Pleurotomaria turbiniformis*	135
6a.	Side view. (Hare collection.)	
6b.	Ornamentation (enlarged).	
	Carboniferous, Upper Coal Measures.	

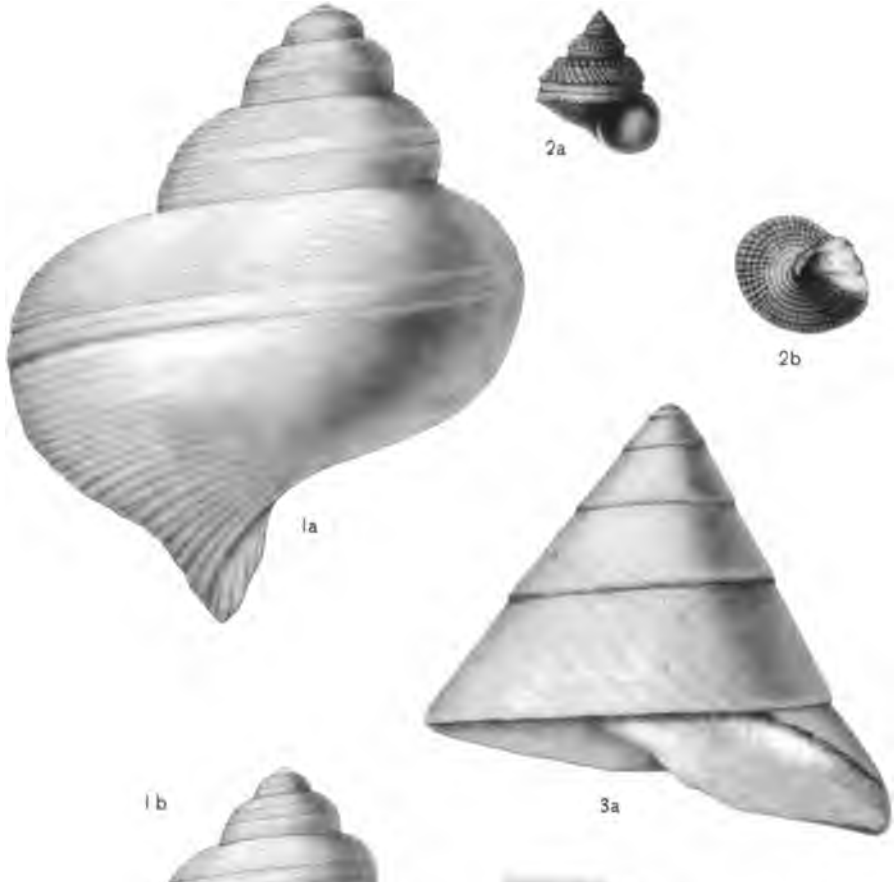


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PLATE XLIX.

EXPLANATION OF PLATE XLIX.

		Page
FIG. 1.	*Pleurotomaria missouriensis*	136
	Another view of specimen shown on preceding plate.	
FIG. 2.	*Pleurotomaria subcarbonaria*	135
2a.	Type specimen. (Rowley collection.)	
	Carboniferous, Burlington limestone.	
FIG. 3.	*Murchisonia melaniformis?*	145
	Side view. (Mus. Mo. Geol. Sur.)	
	Cambrian?	
FIG. 4.	*Murchisonia terebra*	146
	A somewhat worn specimen. (Hare collection.)	
	Carboniferous, Upper Coal Measures.	
FIG. 5.	*Murchisonia major*	145
5a.	Specimen with shell. (Mus. Mo. Geol. Sur.)	
5b.	Internal cast. (Same collection.)	
	Silurian, Trenton limestone.	

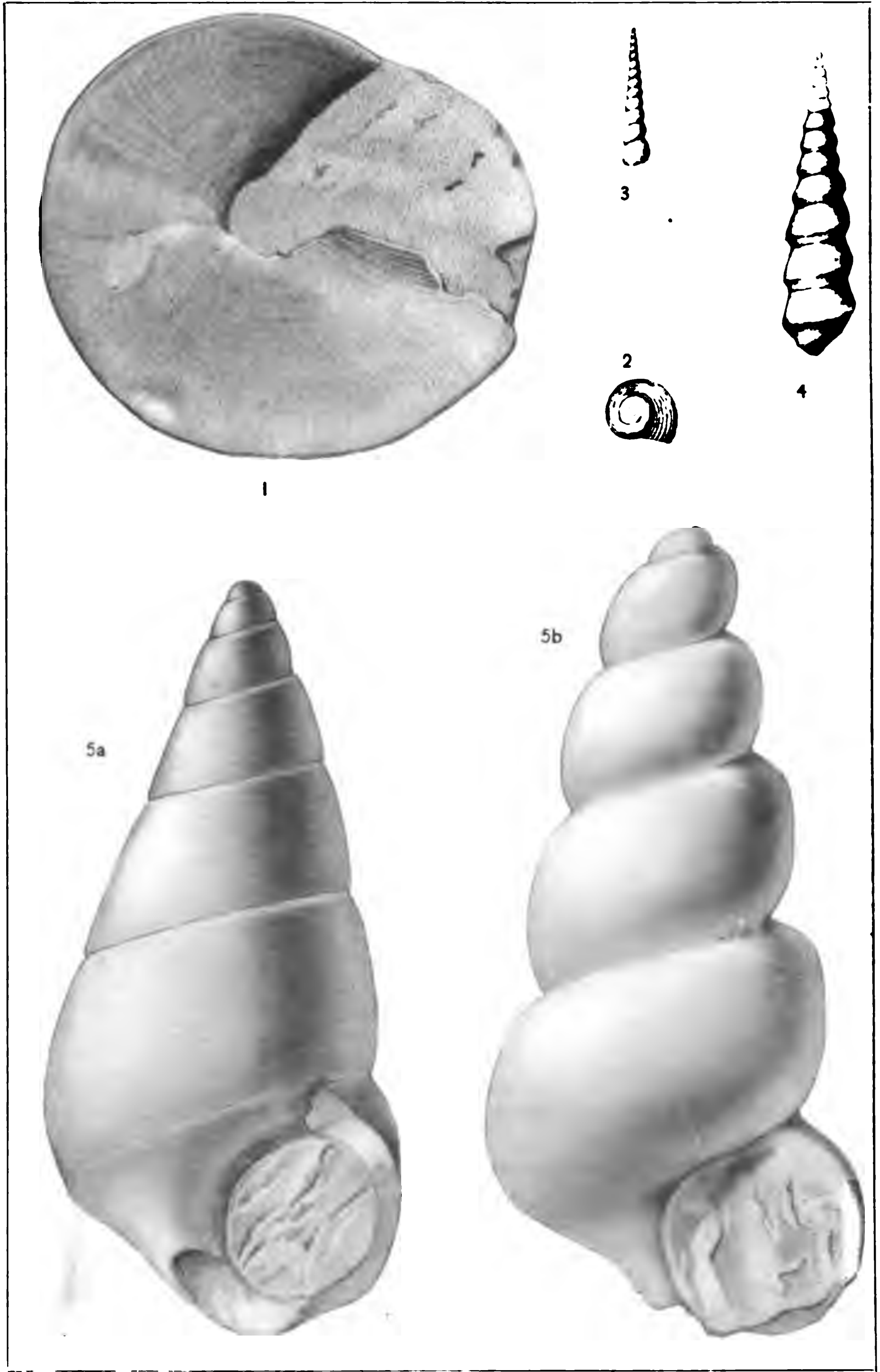

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PLATE L.

Explanation of Plate L.

			Page
Fig. 1.		*Bellerophon crassus*	151
	1a.	View of aperture.	
	1b.	Side aspect.	
		Carboniferous, Upper Coal Measures.	
Fig. 2.		*Bellerophon percarinatus*	153
	2a.	Dorsal aspect.	
	2b.	Apertural view.	
	2c.	Same of another individual.	
	2d.	Dorsal aspect.	
	2e.	Side view.	
	2f.	Same of another example.	
		Carboniferous, Coal Measures.	
Fig 3.		*Bellerophon bilabiatus*	147
		Dorsal aspect. (Keyes collection.)	
		Carboniferous, Burlington limestone.	
Fig. 4.		*Bellerophon nodocarinatus*	152
	4a.	Side view.	
	4b.	View of aperture.	
	4c	Dorsal aspect.	
		Carboniferous, Coal Measures.	
Fig. 5.		*Bellerophon urii*	149
	5a.	Dorsal aspect.	
	5b.	Side view.	
	5c.	View of aperture.	
		Carboniferous, Coal Measures.	
Fig. 6.		*Bellerophon panneus*	147
		Dorsal aspect. (Keyes collection.)	
		Carboniferous, Burlington limestone.	
Fig 7		*Bellerophon bellus*	148
		Dorsal aspect of type. (Keyes collection.)	
		Carboniferous, Upper Coal Measures.	

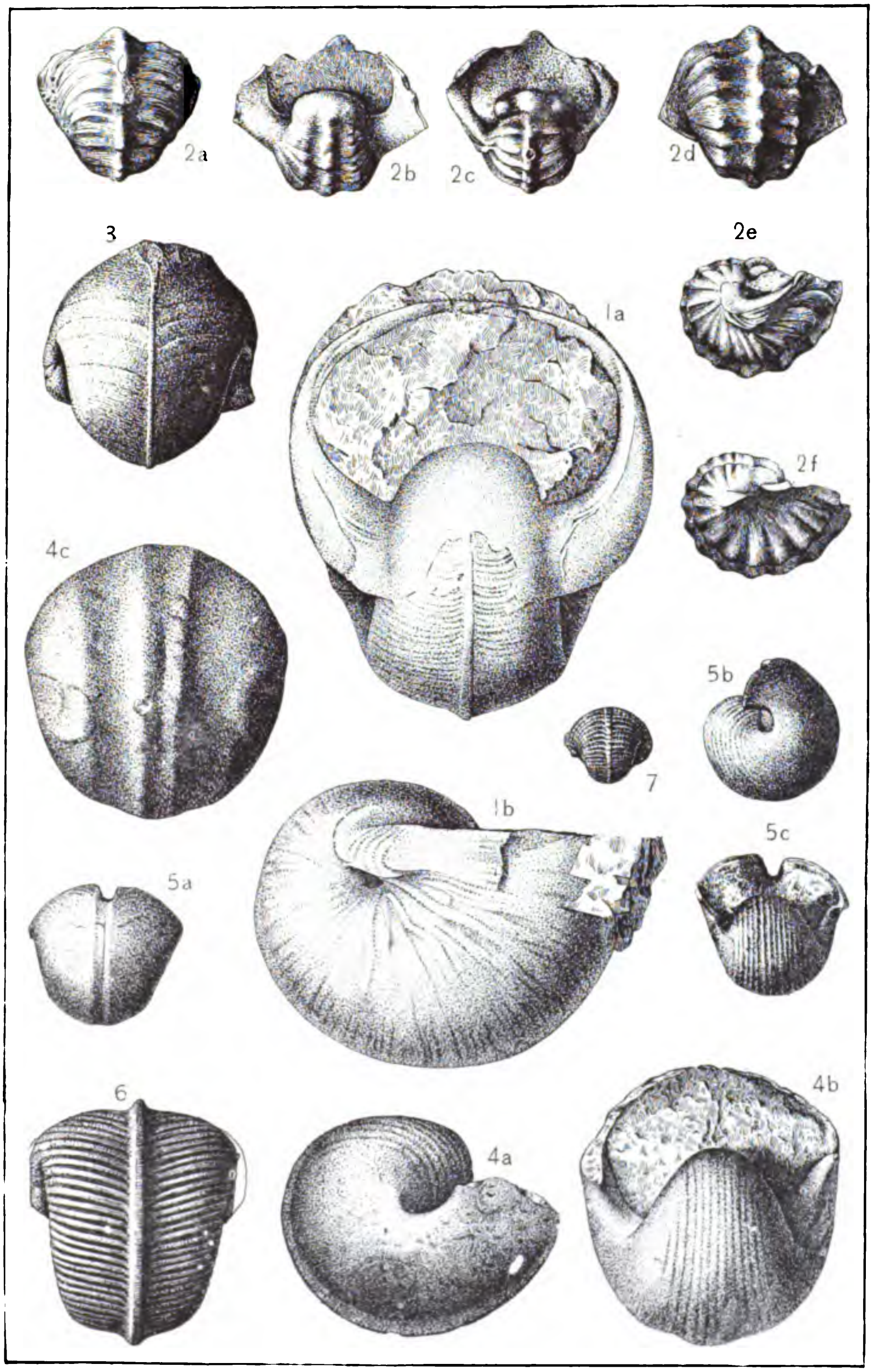

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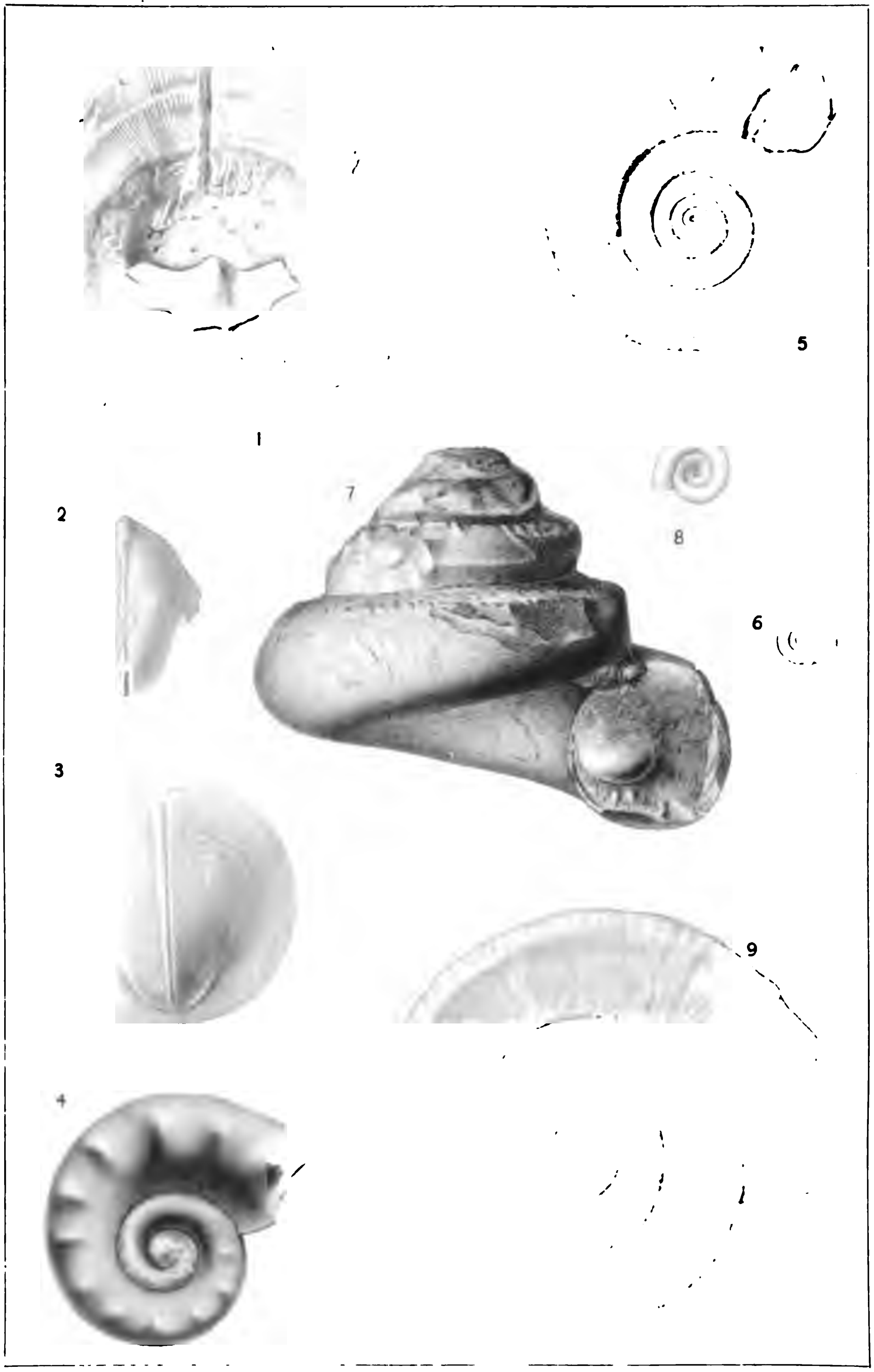
PLATE LI.

EXPLANATION OF PLATE LI.

		Page
FIG. 1.	*Bellerophon sp.?* Apertural aspect. (Hare collection.) Carboniferous, Upper Coal Measures.	
FIG. 2.	*Bellerophon bilobatus?* .... Dorsal aspect. (Rowley collection.) Silurian, Trenton limestone.	147
FIG. 3.	*Bellerophon marcouanus* .... Dorsal aspect. (Hare collection) Carboniferous, Upper Coal Measures.	148
Fig. 4.	*Porcellia nodosa* .... Side view. (Rowley collection.) Carboniferous, Burlington limestone.	154
Fig. 5.	*Straparollus obtusus* .... View from above. (Keyes collection) Carboniferous, Kinderhook beds.	157
FIG. 6.	*Straparollus ammon* .... View from above. (Rowley collection.) Carboniferous, Burlington limestone.	158
FIG. 7.	*Omphalotrochus springvallensis* .... View of type. (U. S. Nat. Mus.) Carboniferous, Kinderhook limestone.	162
FIG. 8.	*Straparollus valvatiformis* .... View from below. (Mus. Mo. Geol. Sur.) Cambrian.	157
FIG. 9.	*Straparollus latus* .... View from above. (Keyes collection.) Carboniferous, Burlington limestone.	158



GASTEROPODS.

PLATE LII.

EXPLANATION OF PLATE LII.

Page

FIG. 1. *Igoceras capulus* 183
1a. View from above. (Rowley collection.)
1b. Outline from side.
Carboniferous, Burlington limestone.

FIG. 2. *Igoceras fissurella* 186
Side view. (Keyes collection.)
Carboniferous, Keokuk limestone.

FIG. 3. *Igoceras pabulocrinus* 184
Specimen attached to *Platycrinus hemisphericus*. (Keyes collection.)
Carboniferous, Keokuk limestone.

FIG. 4. *Pleurotomaria sp ?*
Side view. (Rowley collection.)
Carboniferous, Burlington limestone.

FIG. 5. *Pleurotomaria sp ?*
Side view
Carboniferous, Burlington limestone.

FIG. 6. *Strophostylus peoriensis* 197
Apertural view. (Keyes collection.)
Carboniferous, Coal Measures.

FIG. 7. *Phanerotinus paradoxus* 164
Lateral view.
Carboniferous, Burlington limestone.

FIG. 9. *Maclurea magna* (young) ? 168
9a. View from above. (Mus. Mo. Geol. Sur.)
9b. Apertural aspect of same.
Silurian, Trenton limestone.

FIG. 10. *Capulus equilateralis* 178
10a. Lateral aspect. (Keyes collection.)
10b. Apertural aspect of a specimen which was probably attached to a *Platycrinus*.
Carboniferous, Keokuk limestone.

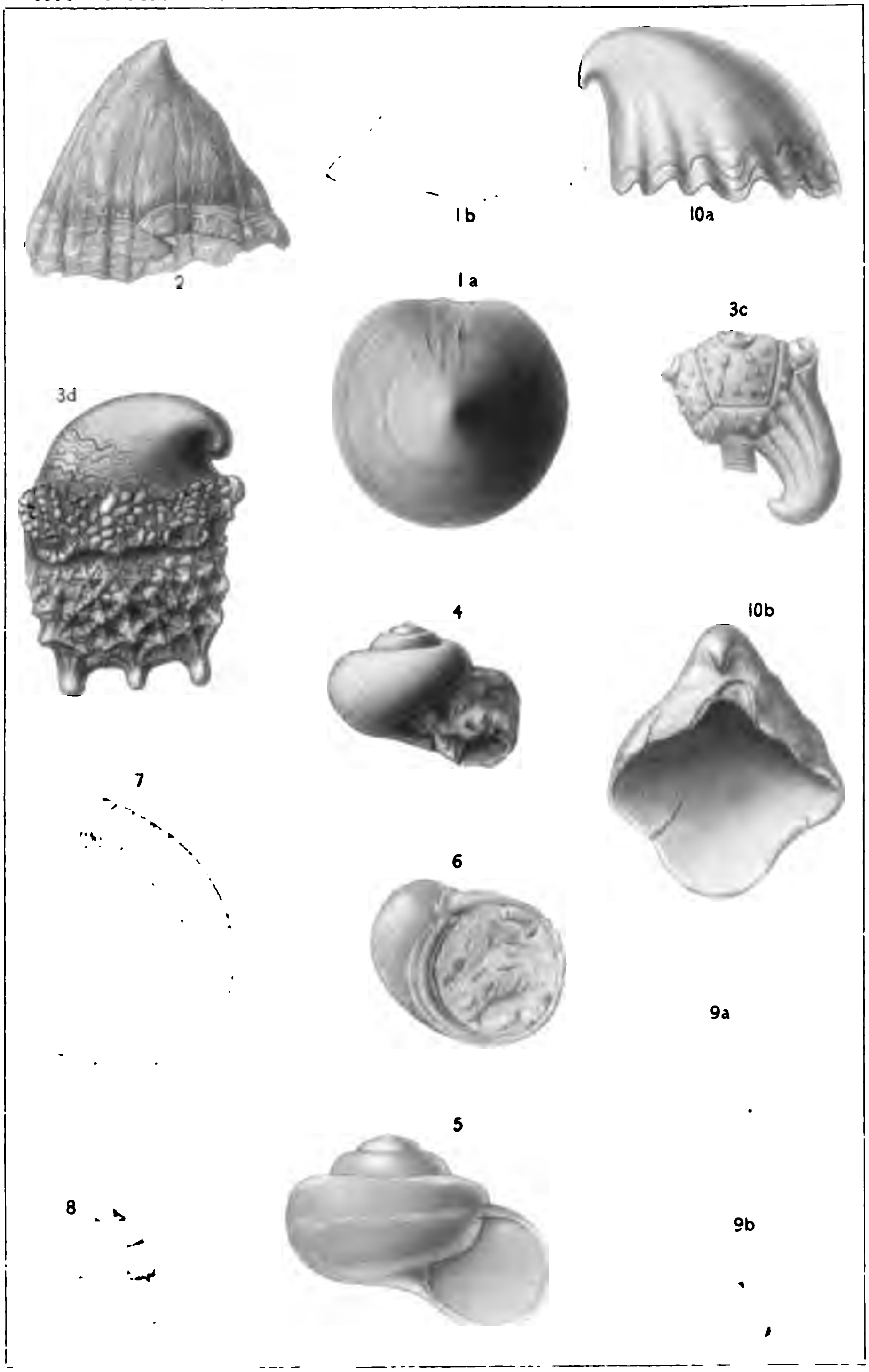


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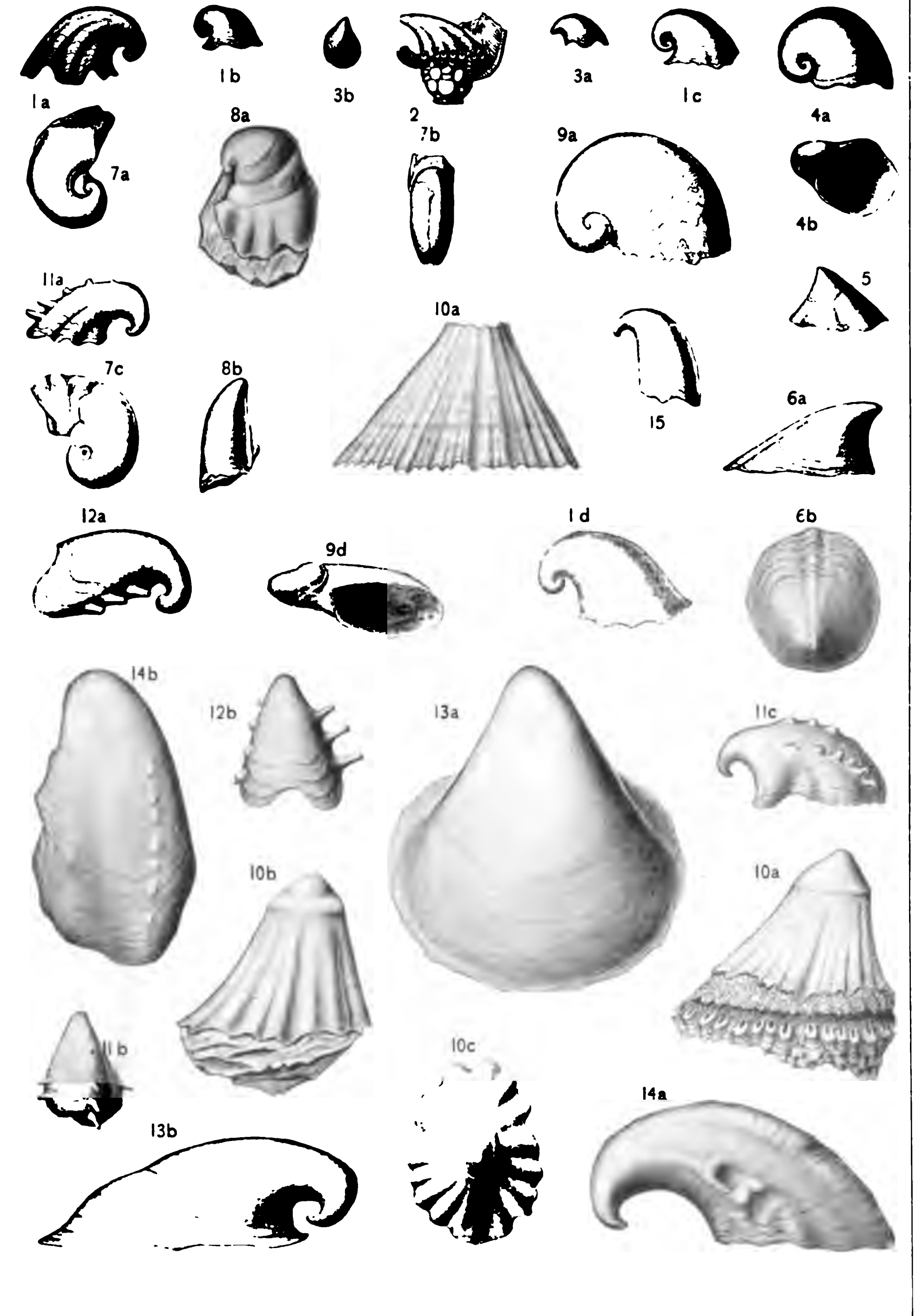
PLATE LIII.

EXPLANATION OF PLATE LIII.

		Page.
FIG. 1.	*Capulus paralius*	174
1a.	Lateral view of type. (Mus. Michigan Univ.)	
1b.	Lateral view of young specimen. (Keyes collection.)	
1c.	Lateral view of another immature specimen. (Keyes collection.)	
1d.	Lateral view of a natural cast. (Collection of J. S. Newberry.) Carboniferous, Kinderhook limestone.	
FIG. 2.	*Orthonychia formosum*	189
	Lateral view of type, attached to the vault of *Dorycrinus immaturus* Wachs. & Spr. (Collection of Wachsmuth & Springer.) Carboniferous, Kinderhook limestone.	
FIG. 3.	*Orthonychia cornuformis*.	
FIG. 4.	*Strophostylus bivolvis* (White & Whitfield).	
FIG. 5.	*Igoceras subplicatum*.	
FIG. 6.	*Capulus lodensis*.	
FIG. 7.	*Capulus piso*.	
FIG 8.	*Capulus occidens*.	
FIG. 9.	*Capulus haliotoides*	174
9a.	Lateral view. (Collection of J. S. Newberry.)	
9b.	Apertural aspect of same.	
FIG. 10.	*Igoceras quincyense*	182
10a.	Lateral view, apical portion broken. (Keyes collection.)	
10b.	Lateral view of an exfoliated specimen. (Keyes collection.)	
10c.	Apical aspect of same.	
10d.	A specimen attached to the vault of *Physetocrinus ventricosus* Hall, lower portion of the crinoidal calyx not shown. (Collection Wachsmuth & Springer.) Carboniferous, Burlington limestone.	
FIG. 11.	*Capulus tribulosus*	175
11a.	Lateral view. (Keyes collection.)	
11b.	Dorsal aspect of same.	
11c.	Lateral view of type. (Collection of E. O. Ulrich.) Carboniferous, Burlington limestone.	
FIG. 12	*Capulus biserialis*	177
12a.	Lateral view of type. (After Meek & Worthen.)	
12b.	Dorsal aspect of same. Carboniferous, Burlington limestone.	
FIG. 13.	*Capulus latus*	176
13a	Dorsal view of type. (Keyes collection.)	
13b.	Lateral aspect of same. Carboniferous, Burlington limestone.	
FIG 14.	*Capulus obliquus*	177
14a.	Dorsal view of type. (Keyes collection.)	
14b.	Lateral aspect of same. Carboniferous, Burlington limestone.	
FIG 15.	*Orthonychia cyrtolites*	188
	Lateral aspect. (Keyes collection.) Carboniferous, Burlington limestone.	



GASTEROPODS

PLATE LIV.

EXPLANATION OF PLATE LIV.

Page

FIG. 1. *Orthonychia chesterense* 191

1a. Lateral view. (Keyes collection.)

1b. Lateral view of another specimen.

1c. Lateral aspect of specimen attached to *Pterotocrinus acutus*, with only a portion of the dome shown and the radial dome plates broken away.

1d. View from above of another specimen resting on the same species of crinoid. (1b-d in collection Wachsmuth and Springer.)

Carboniferous, Kaskaskia limestone.

FIG. 2. *Orthonychia acutirostris* 190

2a. Lateral view

2b. Dorsal view of another specimen. (After Whitfield.)

2c. Lateral aspect of same.

Carboniferous, Keokuk limestone.

FIG. 3. *Igoceras pabulocrinus* 184

3a-b. Specimen attached to *Platycrinus hemisphericus* Meek & Worthen. (Keyes collection.)

3c-k. Other specimens which were also attached to the same species of crinoid.

3l. Lateral view of same.

3m. Posterior view of a natural cast showing muscular scars. (After Meek & Worthen)

Carboniferous, Keokuk limestone.

FIG. 4. *Capulus spinigerus*

4a. Lateral view. (After Worthen.)

4b. Another aspect of same.

FIG 5. *Capulus parvus* 180

5a. Dorsal view of specimen supposed to be the type. (Museum State University of Missouri.)

5b. Lateral aspect of same.

5c. Posterior aspect of same.

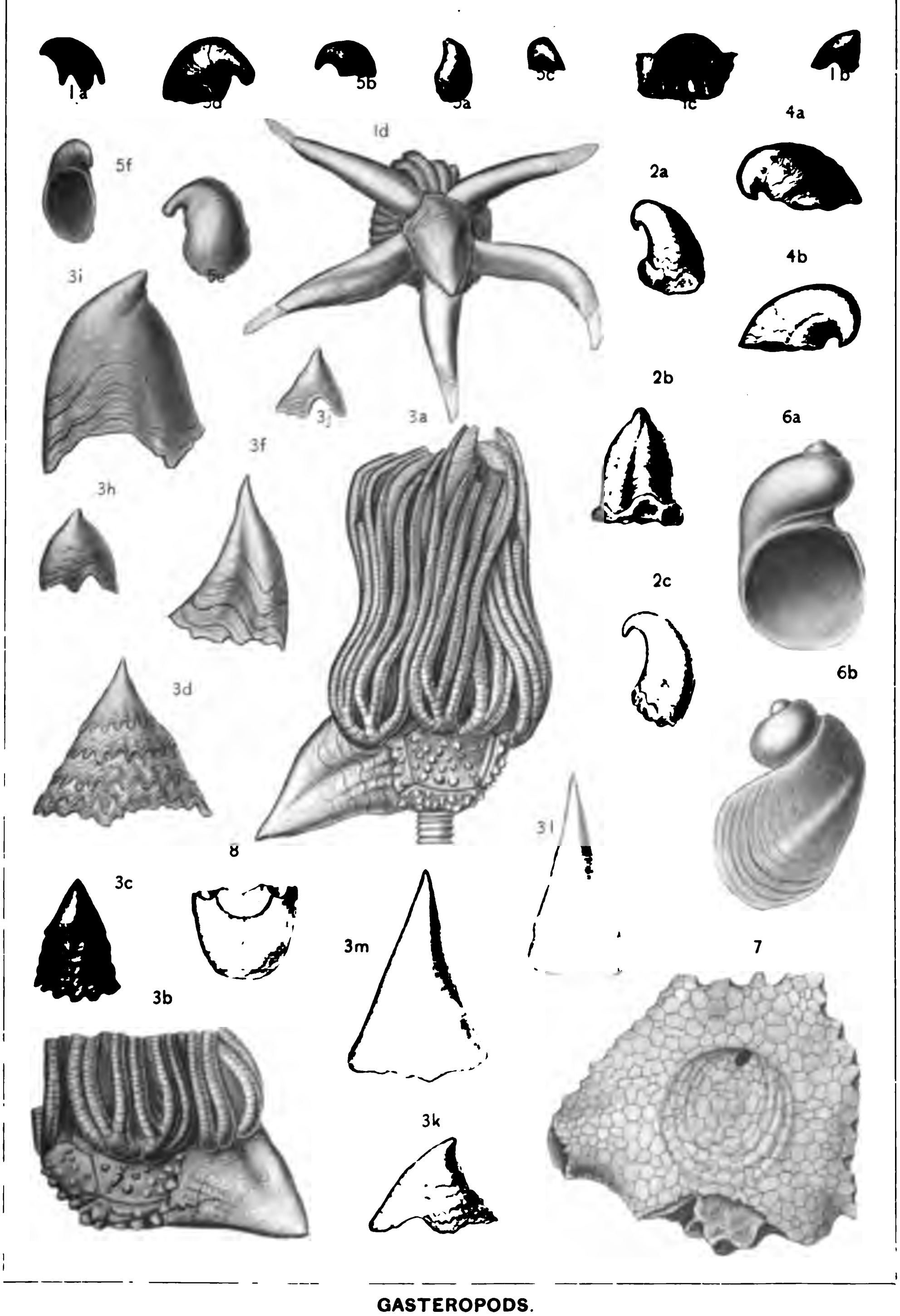
5d. Posterior view of another specimen. (After White.)

FIG. 6. *Naticopsis tortum* (Meek).

6a-b. Apertural and dorsal views of type. (Collection of J. S. Newberry)

FIG 7. Portion of the vault of *Strotocrinus regalis* Hall, showing the impression made by a growing shell of Capulus.

FIG. 8. Calyx of *Platycrinus pileiformis* Hall, showing the impression made by a Capulus on the anal side of the crinoid.



GASTEROPODS.

PLATE LV.

EXPLANATION OF PLATE LV.

		Page.
FIG. 1.	*Loxonema sp.?* Lateral aspect. (Rowley collection.) Carboniferous, Burlington limestone.	
FIG. 2.	*Loxonema sp.?* Lateral view. (Rowley collection.) Carboniferous, Burlington limestone.	
FIG. 3.	*Gen. et sp. nov.* 3a. View of specimen. (Hare collection.) 3b. Opposite aspect of same, showing columella Carboniferous, Upper Coal Measures.	
FIG. 4.	*Soleniscus sp.?* 4a. Specimen with part of body-whorl removed. (Hare collection.) 4b. Another specimen. (Same collection.) Carboniferous, Upper Coal Measures.	
FIG. 6.	*Bulimorpha inornata* .... Lateral view. (Hare collection.) Carboniferous, Upper Coal Measures.	205
FIG. 7.	*Strophostylus remex* .... 7a. Apertural view. (Keyes collection.) 7b. Opposite aspect of same. Carboniferous, Upper Coal Measures.	197
FIG. 8.	*Trachydomia wheeleri* .... Lateral view. (Keyes collection.) Carboniferous, Upper Coal Measures.	200

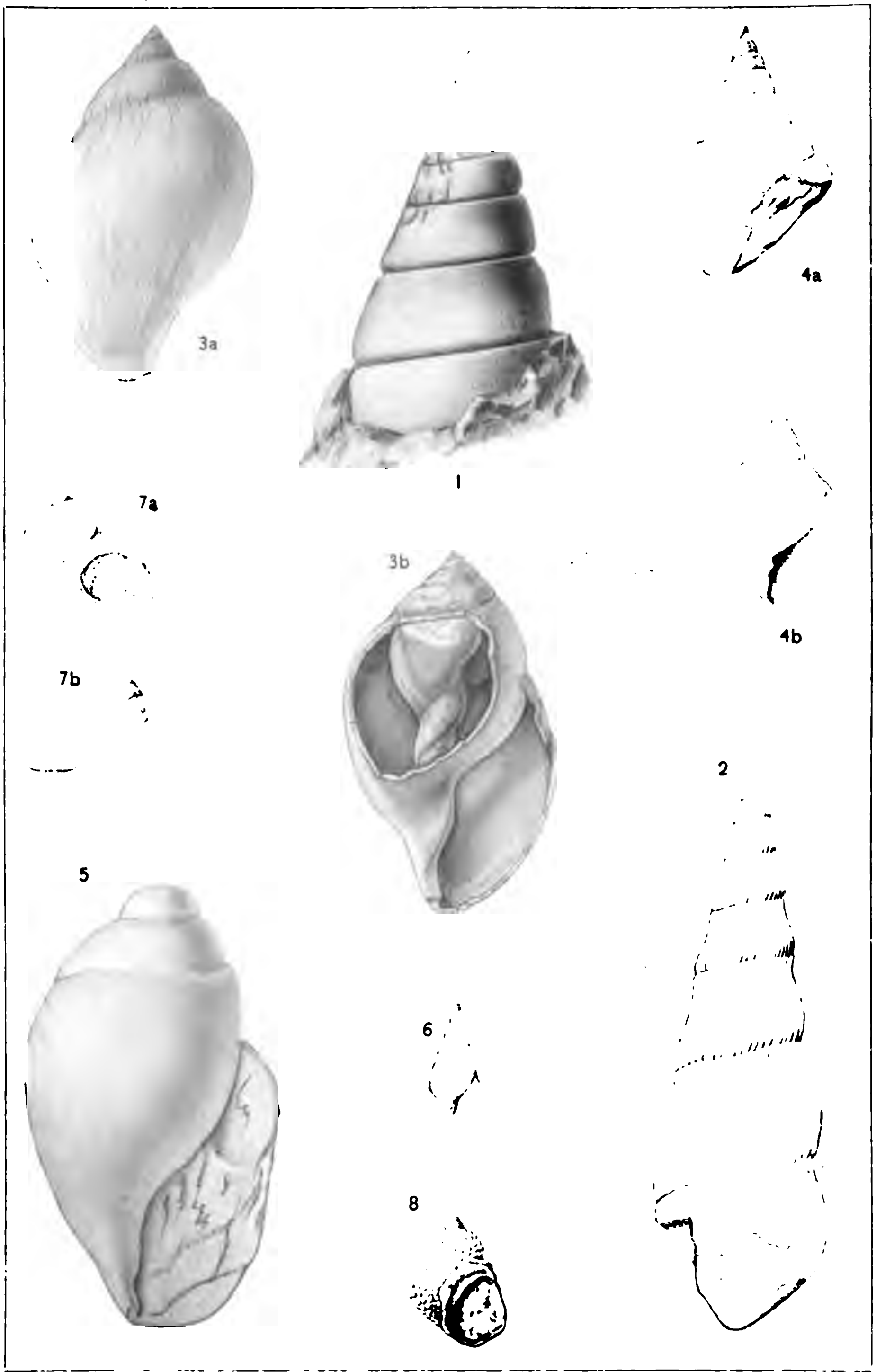


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PLATE LVI.